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Species

Distribution and new records of cave dwelling bats from Fars province in south west of Iran

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ABSTRACT

Studies on the mammalian fauna of Iran, including bats has been reported infrequently since early 20th century. Reports on distribution and abundance of bats in the Fars Province are scarce. We located caves based on reports from published papers and information received from Department of Environment and cave climbers. Live bats were captured using hand or mist net. Identification of bats was based on keys and measurement of external features including: Body Length, Tail Length, Forearm Length, Ear Length, Tragus length and Length of Hind foot. We provided a list of bat records available from Fars Province. This included 24 of 50 bats reported from Iran. These species are belonged to 8 families and 14 genera. We visited 69 caves, of which 27 caves contained at least one species of bat. Seventeen cavernicolous bat species recorded in this study include *Rousettus aegyptiacus* from family Pteropodidae, *Rhinopoma microphyllum*, *R. hardwickii* and *R. muscatellum* from family Rhinopomatidae, *Triaenops persicus* and *Asellia tridens* from family Hipposideridae, *Myotis blythii*, *M. capaccinii, M. emarginatus* from family Vespertilionidae, *Miniopterus pallidus* from family Miniopteridae, *Taphozous perforates* from Family Emballonuridae, *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale, R. mehelyii* and *R. blasii* from family Rhinolophidae. Diversity and abundance of the cave-dwelling bat fauna vary greatly from few individual of one species to few thousand of up to ten species. Recommendations are made to protect most diverse and

populated caves such as Tadovan (10 species), Palangan (6 species), SangEshkan (6 species), Shefagh (6 species) and Sahlak (5 species).

Key Words: Chiroptera, Cave, Distribution, Fars, Iran, Zagros ranges.

1. INTRODUCTION

Nearly half of all genera of bats utilize caves as day roosts, courtship, and mating sites, maternity roosts, and hibernacula (Adams et al. 2013; Furey and Racey 2016). Caves provide a structurally and climatically stable appropriate microclimate. Since bats have high surface to volume ratios, they risk extensive water loss, which can be minimized in high humidity environments in caves (Furey and Racey 2016). Caves also provide protection against adverse weather and protection against predators (Culver and Pipan 2009). Environments in the immediate vicinity of the cave are unlikely to provide all the food resources needed. Therefore, bats may need to fly several kilometers to find food. Many temperate zone bats in the families of Vespertilionidae, Rhinolophidae, and Molossidae form large hibernating colonies (Culver and Pipan 2009; Furey and Racey 2016). Growth in limestone quarrying and cave tourism industries worldwide severely threatens cave-dwelling bats, in addition to loss of foraging habitat, hunting for bushmeat, incidental disturbance, and disruptive guano harvesting. Apparent declines of cave bats in Europe and North America also pose serious concerns, as do global climate change predictions (Furey and Racey 2016).

Fars Province is one of the thirty-one provinces of Iran that located in the southwestern portion of the country. Fars is separated from the Persian Gulf only by the narrow low land littoral of the Persian Gulf. The elevation range in this province extends from 450 m in the southern parts to about 4050 m in the northern parts (Boll Mountain), with a mean of 1491 m. The Province is situated in the southwestern portion of Iran. It encompasses most of the southern ends of the main Zagros ranges. This region is of great significance in terms of bat fauna because of suitable geographical and zoogeographical conditions. There are three distinguishable climate zones in northern, western and north-western parts of Fars province. The first covers the northern, the western and the north-west mountainous area, which is significant for its cold and moderate weather, as well as its significant green land. The second region is central, which is significant for its moderate winter with plenty of rain, and warm and dry summer. The third region is located on the south and the south-east of the province, which is significantly dry and moderate in winter, and very hot in summer, because of its lowland.

After rodents, Bats are the most diverse mammalian order in Iran. Mammalian fauna of Iran, including bats, has been thoroughly studied since long time ago, both by Iranian and foreign zoologists (Lay 1967; Etemad 1969; Karami et al. 2008; Benda et al. 2012, Fathipour et al, 2016). Additional information and new records of bats from Iran have been accumulating during the past two decades. DeBlase (1980) gave a very detailed review of history of the bat research in Iran and summarized descriptions of all records published until the late 1970s. The faunal report by DeBlase (1980) represented the most comprehensive summary of the data on the Iranian bats available. Benda et al. (2012) arranged the review of the fauna in a similar order, added all new findings on the bats of Iran, and complemented DeBlase's (1980) view on biology of the bats of Iran. The bat fauna of Fars have not been studied sufficiently since DeBlase (1980). Parts of the Fars Province including the high mountains in north of Shiraz and the western and southern portions of the province have been virtually ignored by DeBlase and other European zoologists (DeBlase, 1980). These neglected areas have geographical and climatic peculiarities causing higher diversity in fauna and flora of the area. It also provides suitable subterranean habitats for many Iranian bat species serving as roosts of maternity colonies, hibernacula as well as roosts used in the transient periods of the year.

The ultimate aim of present study is to determine basic data on distribution and new records of cave dwelling bats of Fars Province. We provide a complete list of bat records available from Fars Province that was compiled from literature and from new records based on our field studies. We also designated conservation value for caves based on diversity and abundance of bat species to initiate a protection scheme centered to the present legislation.

2. MATERIALS AND METHODS

This survey was carried out from November 2008 to September 2015. The study was conducted in Fars Province, south of Iran. It covers an area of about 125,000 km^2 (7.6% of total area of Iran) and is located between latitudes 27°-32°N and longitudes 50°-55°E (Fig. 1). Considering the size of study area, this survey of cave-dwelling species has a nationwide importance. The locality of cavernicolous bats was listed in the table 1 and showed in the Figure 1.

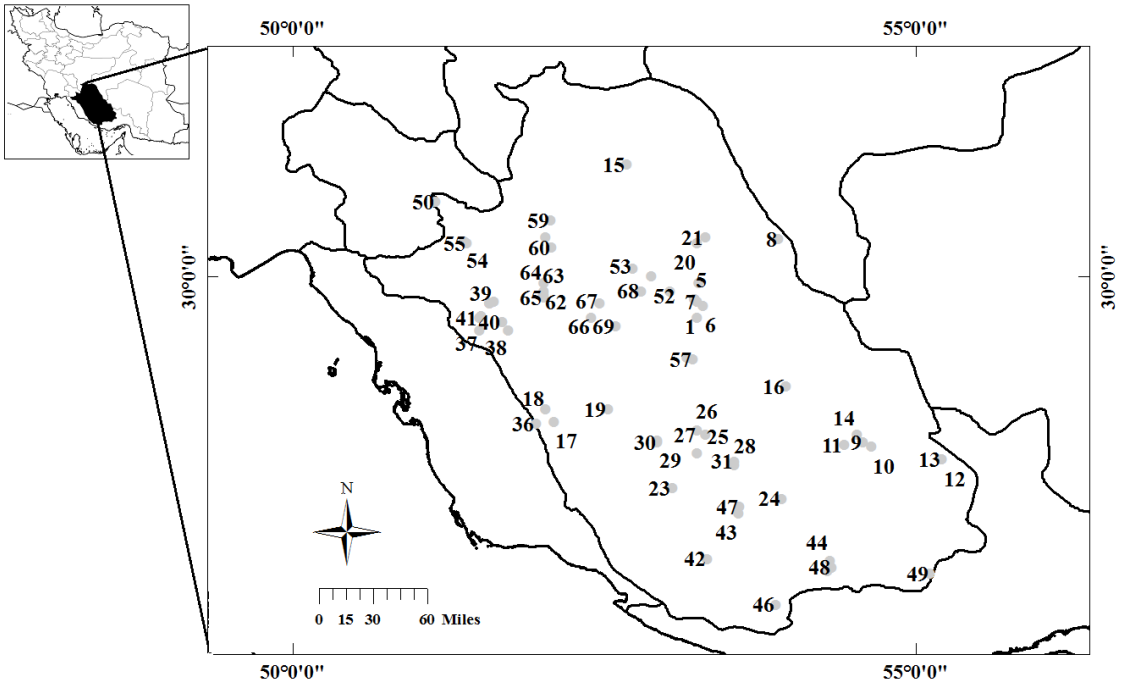

Figure 1

Geographical position of the 69 investigated caves in the Fars Province, southwestern Iran. Numbers correspond to those in Tables 1.

Table 1

A list of the localities of Fars caves and their Bat fauna as well as geographical coordinate. The caves that previously also explored for bats by previous researchers are shown in by aster symbol. (LN = Locality number (showed in the distribution Maps of species and caves, Fig. 1).

LN	Locality	Latitude	Longitude	Species
1	Arsanjan, Dokohak cave	29° 40' N	53° 15' E	*R. microphyllum, R. muscatellum, R. hardwickeii*
2	Arsanjan, Eshkaft Khobrizi cave	29° 49' N	53° 14' E	*R. microphyllum, R. muscatellum, R. hardwickeii*
3	Arsanjan, Eshkaft-e tireh kol cave	29° 49' N	53° 14' E	*Rhinolophus sp.*
4	Arsanjan, Gowhardan cave	29° 57' N	53° 16' E	*R. microphyllum*
5	Arsanjan, Kaleh Nazari cave	29° 49' N	53° 14' E	*Rhinolophus sp.*
6	Arsanjan, Khong cave	29° 46' N	53° 18' E	*R. ferrumequinum*
7	Arsanjan, Ziad abad cave	29° 48' N	53° 15' E	*R. microphyllum,Rhinopoma sp.*
8	Bavanat, Kangowhar cave	30° 18′ N	53° 54′ E	*Rhinolophus sp.*
9	Darab, Banuj cave	28° 40′ N	54° 35′ E	*R. microphyllum*
10	Darab, Dehkheir-e sofla	28° 38' N	54° 39' E	*R. aegypthiacus*
11	Darab, Herbedan, Chelleh Khaneh	28° 39' N	54° 26' E	*R. microphyllum*
12	Darab, Fath cave	28° 32′ N	55° 13′ E	*R. mehelyi*
13	Darab, Sahlak (Mozafar cave)	30° 14′ N	52° 05′ E	*M. blythii, M. pallidus, R. ferrumequinum, R. hipposideros, R. blasii*
14	Darab's Forg, Galooye Ab Bordeh	28° 44' N	54° 32' E	*R. muscatellum*

	cave			
15	Eghlid, Dasht-e bokan, Lileman cave	30° 54' N	52° 41' E	*M. blythii, M. pallidus*
16	Estahban-Zakaria cave	29° 7' N	53° 58' E	*R. hipposideros, R. ferrumequinum*
17	Farashband, Farashband cave	28° 50′ N	52° 06′ E	*R. muscatellum*
18	Farashband, Aviz$_9$ Chak cave	28° 56′ N	52° 02′ E	*R. muscatellum*
19	**Firuz Abad, Serizjan cave*	28° 56′ N	52° 32′ E	*M. blythii,*
20	Ghader abad, Hana cave	30° 16' N	53° 15' E	*M. blythii, M. pallidus*
21	Ghader-Abad, Shabpareh cave	30° 19' N	53° 19' N	*R. euryale, R. ferrumequinum, R. mehelyi, M. pallidus, M. blythii,*
22	Ghaemiyeh, Kaleh Kaftari cave	29° 47′ N	51° 35′ E	*M. pallidus, R. microphyllum*
23	Ghirkarzin, Abgarm cave	28° 18′ N	53° 03′ E	*R. muscatellum, R. aegyptiacus*
24	**Jahrom, Fereshteh Jân, qanat*	28° 13′ N	53° 56′ E	*A. tridens*
25	**Jahrom, Gorm,Tang-e Tekhe cave*	28° 44′ N	53° 19′ E	*R. aegyptiacus*
26	**Jahrom, Gorm,Tang-e Zorok cave*	28° 46′ N	53° 15′ E	*R. aegyptiacus*
27	Jahrom, Manian cave	28° 35′ N	53° 15′ E	*R. muscatellum, R. microphyllum, R. aegypthiacus*
28	**Jahrom, Sang Eshkan cave*	28° 29′ N	53° 33′ E	*R. muscatellum, T. persicus, A. tridens, Rousettus aegyptiacus, R. microphyllum, T. perforates*
29	Jahrom, Simakan, Bishu cave	28˚ 41' N	52˚ 56' E	*R. microphyllum, R. ageptiacus*
30	Jahrom, Simakan, Shefagh cave	28˚ 40' N	52˚ 56'E	*R. microphyllum, R. hardwickeii, M. pallidus, M. blythii, R. aegyptiacus, Asellia tridens*
31	**Jahrom, Tadovan(Canae Gabru) cave*	28° 31' N	53° 33' E	*R. hipposideros, R. ferrumequinum, R. blasii, R. euryale, R. mehelyi, M. pallidus, M. blythii, R. microphyllum, R. muscatellum, M. capaccinii*
32	Kazerun, Bushigan-e daylami cave	29° 41′ N	51° 31′ E	*R. aegyptiacus*
33	**Kazerun, Dej-e Shahpur cave*	29° 47′ N	51° 35′ E	*R. aegyptiacus, R. microphyllum, R. muscatellum, M.blythii,* remnants of *P. pipistrellus*
34	Kazerun, Ghaleh-e dokhtar cave	29° 47′ N	51° 35′ E	*R. aegyptiacus, R. microphyllum, R. muscatellum*
35	Kazerun, Ghaleh-e Pesar cave	29° 47′ N	51° 35′ E	*R. aegyptiacus, R. microphyllum, R. muscatellum*
36	Kazerun, Khesht Cave	28° 34′ N	51° 30′ E	*R. muscatellum, A. tridens*
37	Kazerun, Konartakhteh cave	29˚ 34′ N	51˚ 30′ E	*R. microphyllum*
38	Kazerun, Pole Abgineh cave	29° 34′ N	51° 44′ E	*R. microphyllum, R. muscatellum*
39	**Kazerun, Shahpur cave*	29° 48′ N	51° 37′ E	*R. ferrumequinum, M. pallidus, M. capaccinii, P. pipistrellus, R. hipposideros, R. mehelyi. P. Kuhlii*
40	Kazerun, Tang-e Tikab cave	29˚ 38' N	51˚ 41 E	*R. microphyllum, R. muscatellum, A. tridens, R. ageptiacus*
41	Kazerun,Tang-e-torkan cave	29° 40' N	51° 30' E	*R. aegypthiacus*
42	Khonj, Khan cave	27° 44' N	53° 20' E	*R. muscatellum, R. hardwickeii, A. tridens*
43	Larestan- Bolghan cave	28° 6' N	53° 35' E	*R. microphyllum, R. muscatellum*
44	Larestan, Abbarik, tunnel	27° 43′ N	54° 19′ E	*R. microphyllum, R. muscatellum*
45	Larestan, Baghanjir cave	27° 38′ N	54° 18′ E	*R. microphyllum, R. muscatellum*
46	Larestan, Bonow cave	27˚ 22' N	53˚ 53' E	*R.microphyllum*

47	Larestan, Joyum, Sangi cave	34° 45′ N	47° 05′ E	*R. microphyllum, R. muscatellum*
48	Larestan, Old building in a garden	27° 40' N	54° 20' E	*A. tridens*
49	Larestan-Ahuh-Charkhab cave	27° 32′ N	55° 20′ E	*R. muscatellum, R. blasii*
50	Mamasani,Gharibkhaneh cave	30° 36' N	51° 09' E	*R. ferrumequinum, R. hipposideros*
51	Marvdasht, Khafrak cave	29° 53′ N	53° 02′ E	*R. microphyllum, Rhinopoma sp.*
52	Marvdasht, Haji Abad cave	30° 00' N	52° 53 ' E	*R. microphyllum,R. muscatellum*
53	Marvdasht, Palangan cave	30° 3.5' N	52° 44' E	*R. euryale, R. hipposideros,R. ferrumequinum, M. capaccinii, M. blythii, M. pallidus*
54	Norabad- Crevice near Showpari cave	20° 17' N	51° 23' E	*R. microphyllum*
55	Norabad-Showpari cave	30° 16' N	51° 24' E	*R. hardwickii, R. muscatellum, A. tridens*
56	Sarvestan, Chah jenni (tomp-e kocheh) cave	29° 21′ N	53° 10′ E	*M. blythii*
57	Sarvestan,Codoni cave	29° 20' N	53° 13' E	*R. hardwickii, R. microphyllum,R. muscatellum*
58	Sepidan, Angareh-Minu cave	30° 19' N	52° 02' E	*R. ferrumeguinum*
59	Sepidan, Behesht-e makan cave	30° 24′ N	52° 04′ E	*R. ferrumeguinum, Rhinolophus sp.*
60	Sheshpir, Dalkhon cave	30° 14′ N	52° 05′ E	*R. ferrumequinum*
61	Shiraz, Balazar , Chemeh-Taalo cave	29° 50' N	52° 01' E	*R. ferrumequinum*
62	Shiraz, Balazar, Ghazal cave	29° 51' N	52° 01' E	*R. ferrumequinum*
63	Shiraz, Balazar, Balazar cave	29° 51' N	52° 01' E	*R. ferrumequinum*
64	Shiraz, Balazar, Gelin cave	29° 50' N	53° 01' E	*R. ferrumequinum, Rhinolophus sp.*
65	Shiraz, Balazar, Lampalangi cave	29° 50' N	52° 01' E	*R. ferrumequinum*
66	Shiraz, Eshkaftalo cave	29° 40' N	52° 24' E	*R. microphyllum, R. muscatellum*
67	Shiraz, Pardis cave	29° 47′ N	52° 28′ E	*R. ferrumequinum*
68	Shiraz, Zendan-e Nasr cave	29° 53' N	52° 48' E	*R. microphyllum, R. muscatellum, M. blythii*
69	Shiraz, Eshkaft Boland cave	29° 36' N	52° 36' E	*Rhinolophus sp.*

Bats were captured using hand net or mist net and then photographed. Identification of bats was upon a series of external characteristics, measurements (DeBlase 1980; Srinivasulu et al., 2010) and echolocation call frequency (Salsamendi et al. 2005; Schuchmann et al. 2010). Taxonomy of bats follows the arrangement by Jones and Teeling (2005) and Eick et al. (2005) with an exceptions; the genus *Miniopterus* follows Furman et al. (2010) and Akmali et al. (2014). 69 caves were surveyed, all of which were visited at least once. The number of bat individuals cannot be exactly counted in each case. Numbers were estimated for large colonies, sometimes with the help of photographs. Geographical position for each cave was recorded using a Garmin GPS unit (GPSMAP 60CSx; Garmin International, Inc., city, state, USA). Coordinates for published localities were achieved from literature cites (Benda et al. 2012). Distribution map of each species was drawn by the software ArcGis (version 10, www.esri.com). The submitted data of species distribution are divided into two parts. In the first part, the new data of the surveys are reported. The data that was previously reported and we have found them again in the present study, are listed in the first part, and determined by references in parenthesis. The second part contains the published data.

3. RESULTS AND DISCUSSION

During present investigation, we report 17 cave dwelling bat species belonging to 8 families and 14 genera from 69 caves in the Province (Fig. 1, Table 1). Figure 1 shows distribution of the studied caves occupied by at least one species. Table 1 represents a list of investigated caves in the present study, geographical coordinate and bat fauna of each cave. Totally 237 records of seventeen cavernicolous bat species documented in Fars from which 143 records were new and reported for the first time in the present study.

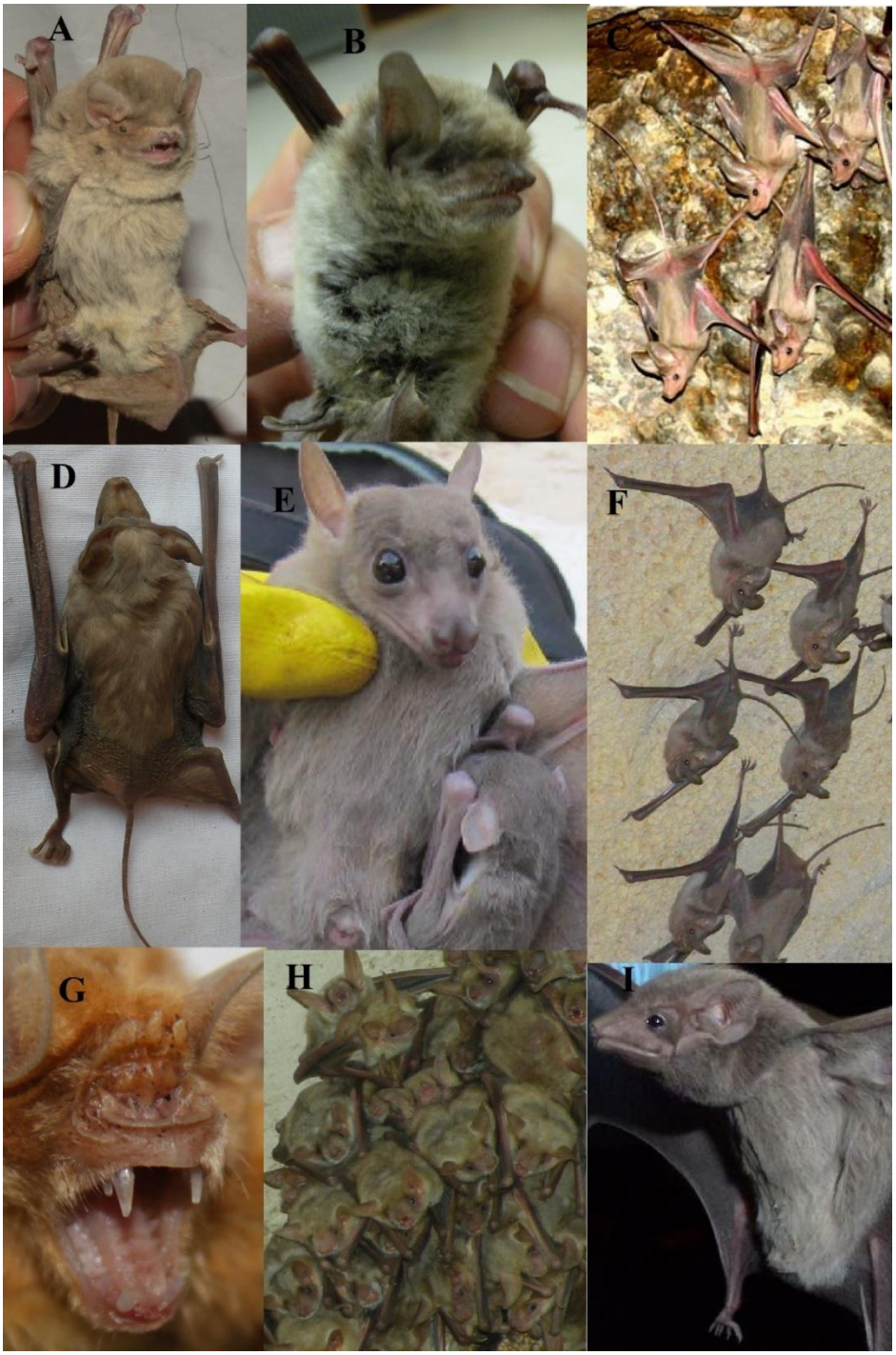

Figure 2

Photo of Bats collected from Fars Province (**A**- *M. pallidus*, **B**-*M. capaccinii*, **C**- *R. hardwickii*, **D**- *R. microphyllum*, **E**-*R. aegyptiacus*, **F**-*R. muscatellum*, **G**-*A. tridens*, **H**- *M. blythii*, **I**-*T. perforatus*).

Family Pteropodidae Gray, 1821 (Old World fruit bats)

***Rousettus aegyptiacus* (Geoffroy, 1810)**

Present data

Locality 1- Darab, Dehkheir-e sofla; **Locality 2-** Ghirkarzin, Abgarm cave; **Locality 3-** Jahrom, Gorm,Tang-e Tekhe cave (Benda et al. 2011a**)**; **Locality 4-** Jahrom, Gorm,Tang-e Zorok cave (Benda et al. 2011a**)**; **Locality 5-** Jahrom, Manian cave (Benda et al. 2011a**)**;

Locality 6- Jahrom, Sang Eshkan cave (Benda et al. 2011a**)**; **Locality 7-**J ahrom, Simakan, Bishu cave; **Locality 8-** Jahrom, Simakan, Shefagh cave; **Locality 9-** Kazerun, Bushigan-e daylami cave (Benda et al. 2011a**)**; **Locality 10-** Kazerun, Dej-e Shahpur cave (Benda et al. 2011a**)**; **Locality 11-** Kazerun, Ghaleh-e dokhtar cave; **Locality 12-** Kazerun, Ghaleh-e Pesar cave; **Locality 13-** Kazerun, Tang-e Tikab cave; **Locality 14-** Kazerun,Tang-e-torkan cave.

Published data

Locality 15- a cave 1.6 km. west of Jahrom (Lay 1967, DeBlase 1980,Bergmans 1994); **Locality 16-** a cave 5.3 km. SW Jahrom (DeBlase 1980, Bergmans 1994); **Locality 17-** Ahmad Mahmoudi cave (Lay 1967, DeBlase 1980, Bergmans 1994); **Locality 18-** Jahrom, Simakân , Sisân garden (Zohoori et al. 2007).

On May 14th 2008, a rift in Abgarm village of Ghir town was visited and two *R. aegyptiacus* (Fig. 2-E) along with 40 *R. muscatellum* were found. On May 15th, 2008, we visited the Tang-e-torkan cave in Kazerun. A population of 2500 to 3000 individuals of *R. aegyptiacus* was found that many of them were pups. On 25 September 2015, we visited Dej-e Shahpur cave and a large colony of approximately 1000 individuals of *R. aegyptiacus* were observed. This species has been recorded frequently from Jahrom and Kazerun by various researchers (Lay 1967; DeBlase 1980; Bergmans 1994; Zohoori et al. 2007; Benda et al. 2012). However, the occurrence of this large-eyed fruit-eating bat is known from 18 Localities in Fars Province (Fig. 3). In this Study, we recorded occurrence of the species from 14 localities (Fig. 3) of which eight were new. Therefore, from 41 localities of this species in Iran, 43.9 percent of all records of this bat in Iran are known from Fars Province (Table 2).

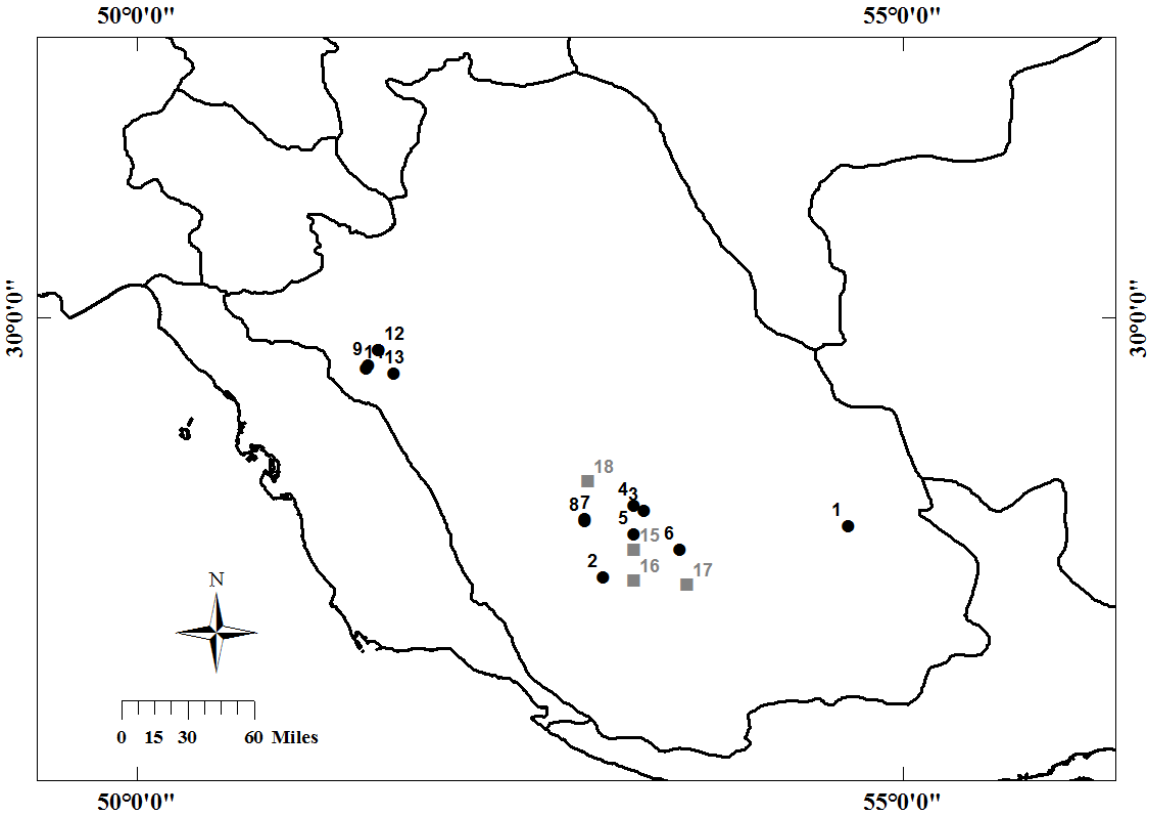

Figure 3

Records of *R. aegyptiacus* in Fars Province. Circles represent records in the present study and squares represent published records.

Table 2

Record number of each species distributed in Iran and Fars Province: all records from Iran to date including new records presented in this survey (All-IR); the number of published records from Fars (Pub-FR), record number in the present study (Pr-St), all records from Fars (All-FR), Percentage frequency of Fars Bats in Iran (FR_IR % = all Records of Fars Bats/All records of Iranian Bats * 100). The most abundant cave dwelling bats in Fars species are: *R. microphyllum, R. muscatellum*, *R. ferrumequinum, R. aegyptiacus, M. blythii,*

M. pallidus. Among Iranian species, *M. capaccinii*, three Rhinopomatid species and *R. aegyptiacus* have been more recorded from Fars rather than other localities of Iran. Dec.[* this record in the present study is the same reported by Benda et al., 2012).

Species	Time observation	Number of records				FR_IR %
		All-IR	Pub-FR	Pr-St	All-FR	
Asellia tridens	Oct., Nov., Dec., Feb., Jan.	43	4	8	12	27.91
Triaenops persicus	Jan., May	5	1	1	2	40.00
Rhinopoma microphyllum	Oct., Nov., May, June, Jan., July, Mar., Aug.	61	7	29	36	59.01
R. hardwickii	Nov., Dec., Oct., Mar., August	18	3	6	9	50.00
R. muscatellum	Oct., Nov., Dec., Jan., Mar., Aug.	63	10	22	32	50.79
Taphozous perforatus	Oct.	7	1*	1	1	14.3
Tadarida teniotis	Apr., Oct.	26	3	0	3	11.54
Miniopterus pallidus	May, Dec., Oct., Nov., July, Mar.	56	5	9	14	25
Rhinolophus blasii	Dec., Mar.	28	1	3	4	14.28
R. hipposideros	Nov., Oct., Sept., Mar.	39	2	6	8	20.51
R. ferrumequinum	Oct., June, Apr., Sep., Mar.	76	4	15	19	24.67
R. euryale	May, Nov., Mar.	19	3	3	6	31.58
R. mehelyi	Dec., Oct., Mar.	16	1	3	4	25.00
Myotis emarginatus	June, Apr.	20	3	0	3	15
M. capaccinii	Oct., Dec., Nov., Mar.	12	4	3	7	58.3
M. blythii	Apr., Oct., May, Mar.	101	9	7	16	15.84
Hypsugo savii	Oct.	19	1	0	1	5.26
Eptesicus serotinus	-	25	4	0	4	16.00
E. anatolicus	Oct.	10	3	0	3	30.00
Pipistrellus pipistrellus	Oct., May, Apr.,Oct., Nov., Aug., July, June, Mar.	63	9	1	10	15.87
P. kuhlii	May, Apr. ,Oct., Nov., Dec., July, June , Mar.	107	17	1	18	16.82
Nyctalus leisleri	-	9	1	0	1	11.11
Otonycteris hemprichii	Aug.	15	1	0	1	6.67
Rousettus aegyptiacus	Apr., Oct., Nov., Jan., June	41	4	14	18	43.9
Total = 24	12	884	94	143	237	26.81

Family Rhinopomatidae Bonaparte, 1838 (Mouse-tailed bats)

Three Rhinopomatid species are known from Iran. The three species have been reported from Fars Province (DeBlase 1980; Akmali et al. 2011; Benda et al. 2012).

***Rhinopoma microphyllum* (Brünnich, 1782)**

Present Study

Locality 1- Arsanjan, Dokohak cave; **Locality 2-** Arsanjan, Eshkaft -e Khobrizi cave; **Locality 3-** Arsanjan, Gowhardan cave; **Locality 4-** Arsanjan, Ziad abad cave; **Locality 5-** Darab, Banuj cave; **Locality 6-** Darab, Herbedan, Chelleh Khaneh; **Locality 7-** Ghaemiyeh, Kaleh Kaftari cave; **Locality 8-** Jahrom, Manian cave (Benda et al. 2012); **Locality 9-** Jahrom, Sang Eshkan cave; **Locality 10-** Jahrom, Simakan, Bishu cave; **Locality 11-** Jahrom, Simakan, Shefagh cave; **Locality 12-** Jahrom, Tadovan (Canae Gabru) cave (Benda et al. 2012); **Locality 13-** Kazerun, Dej-e Shahpur cave (Benda et al. 2012); **Locality 14-** Kazerun, Ghaleh-e dokhtar cave; **Locality 15-** Kazerun, Ghaleh-e Pesar cave; **Locality 16-** Kazerun, Konartakhteh cave; **Locality 17-** Kazerun, Pole Abgineh cave ; **Locality 18-** Kazerun, Tang-e Tikab cave; **Locality 19-** Larestan- Bolghan cave; **Locality 20-** Larestan, Abbarik, tunnel; **Locality 21-** Larestan, Baghanjir cave; **Locality 22-** Larestan, Bonow cave; **Locality 23-** Larestan, Joyum, Sangi cave; **Locality 24-** Marvdasht, Khafrak cave; **Locality 25-** Marvdasht, Haji Abad cave; **Locality 26-** Norabad- Crevice near Showpari cave; **Locality 27-** Sarvestan,Codoni cave; **Locality 28-** Shiraz, Eshkaftalo cave; **Locality 29-** Shiraz, Zendan-e Nasr cave;

Published data

Locality 30-2 km SE Mansorabad, **Locality 31**– 8 km W Estahbanat, **Locality 32**– 10 km SE Kâzerun, **Locality 33**– 11 km NW Darab (DeBlase 1980), **Locality 33** – Ahmad Mahmoudi cave (Lay 1967, DeBlase 1980); **Locality 34**– Bamu National Park (Etemâd 1984); **Locality 35**– Juyom, Hasan Âbâd (Farâsat 2003); **Locality 36** – Shiraz (DeBlase 1980).

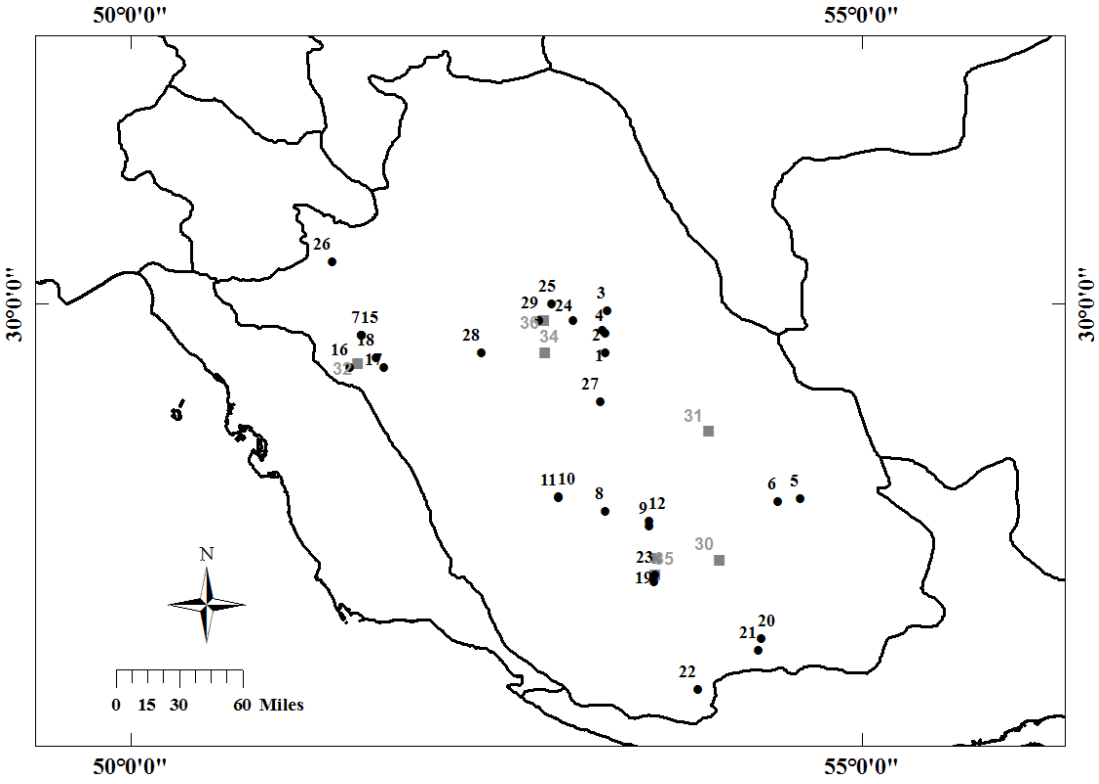

Figure 4

Records of *R. microphyllum* in Fars Province. Circles represent records in the present study and squares represent published records.

A large colony of *Rhinopoma* bats was repeatedly observed in the Tadovan cave. Majority of the bats were *R. microphyllum* (Fig. 2-D) and a smaller number belonged to *R. muscatellum*. On May 16th 2008, a mixed colony of approximately 5000 male and female *R. microphyllum* and *R. muscatellum* were found in a relatively large tunnel in Larestan's Abbarik. There was also about 30 *R. microphyllum* living in a small rift in Baghanjir section of Larestan. There is a big rift in Banuj village at 16 km distance from the south of Darab. On April 4th 2009, we saw a colony of 3000 to 3500 male and female *R. microphyllum* into the rift. There were, also, a few bats in neighboring rifts. There was another cave in Herbedan village at 18 km south-west of Darab. In summer, this low-depth cave called Chelleh Khaneh is the host of female bats coming to give birth. On September 10th 2009, there was a population of approximately 400 bats in this cave. On May 12th 2008, in a rift located in Ahmad Abad village at 2 km distance from the north-east

of Kazerun, there was a colony of 2500 and 3000 *R. microphyllum*. A colony of about 200-300 and a colony of about 500-1000 individuals of this species along with two other mouse tailed bats were found in two caves, Dokohak and Eshkaft-e-Khobrizi in Arsanjan town respectively, in summer 2014.

Generally, we recorded this species from 29 localities in the Province in which 26 localities are new (Fig. 4). It has been already recorded from seven localities in the Province (DeBlase 1980; Etemad 1984; Benda et al. 2012). Totally, this species is known from 61 localities of Iran that 36 records (Fig. 4) are from Fars Province (58.08%), (Table 2).

***Rhinopoma muscatellum* (Thomas, 1903)**

Present Study

Locality 1- Arsanjan, Dokohak cave; **Locality 2-** Arsanjan, Eshkaft Khobrizi cave; **Locality 3-** Darab's Forg, Galooye Ab Bordeh cave; **Locality 4-** Farashband, Farashband cave; **Locality 5-** Farashband, Aviz$_9$ Chak cave; **Locality 6-** Ghirkarzin, Abgarm cave; **Locality 7-** Jahrom, Manian cave (Benda et al. 2012); ; **Locality 8-** Jahrom, Sang Eshkan cave (Benda et al. 2012); **Locality 9-** Jahrom, Tadovan (Canae Gabru) cave (Benda et al. 2012); **Locality 10-** Kazerun, Dej-e Shahpur cave (Benda et al. 2012); **Locality 11-** Kazerun, Ghaleh-e dokhtar cave; **Locality 12-** Kazerun, Ghaleh-e Pesar cave; **Locality 13-** Kazerun, Khesht Cave; **Locality 14-** Kazerun, Pole Abgineh cave ; **Locality 15-** Kazerun, Tang-e Tikab cave; **Locality 16-** Khonj, Khan cave; **Locality 17-** Larestan- Bolghan cave; **Locality 18-** Larestan, Abbarik, tunnel; **Locality 19-** Larestan, Baghanjir cave; **Locality 20-** Larestan, Joyum, Sangi cave; **Locality 21-** Larestan-Ahuh-Charkhab cave; **Locality 22-** Marvdasht, Haji Abad cave; **Locality 23-** Norabad-Showpari cave; **Locality 24-**Sarvestan,Codoni cave; **Locality 25-** Shiraz, Eshkaftalo cave; **Locality 26-** Shiraz, Zendan-e Nasr cave.

Published data

Locality 27- 4 km. WSW of Jahrom (Lay 1967; DeBlase 1980); **Locality 28-** 6.4 km. W Jahrom, (DeBlase 1980; Van Cakenberghe & de Vree 1994); **Locality 29**– 10 km. SE Kazerun, **Locality 30-** Ahmad Mahmoudi cave, **Locality 31**– Eshgeft-Raana cave 5 kms. north of Kazerun (DeBlase 1980); **Locality 32** – Juyom, Hasan Âbâd (Farâsat 2003).

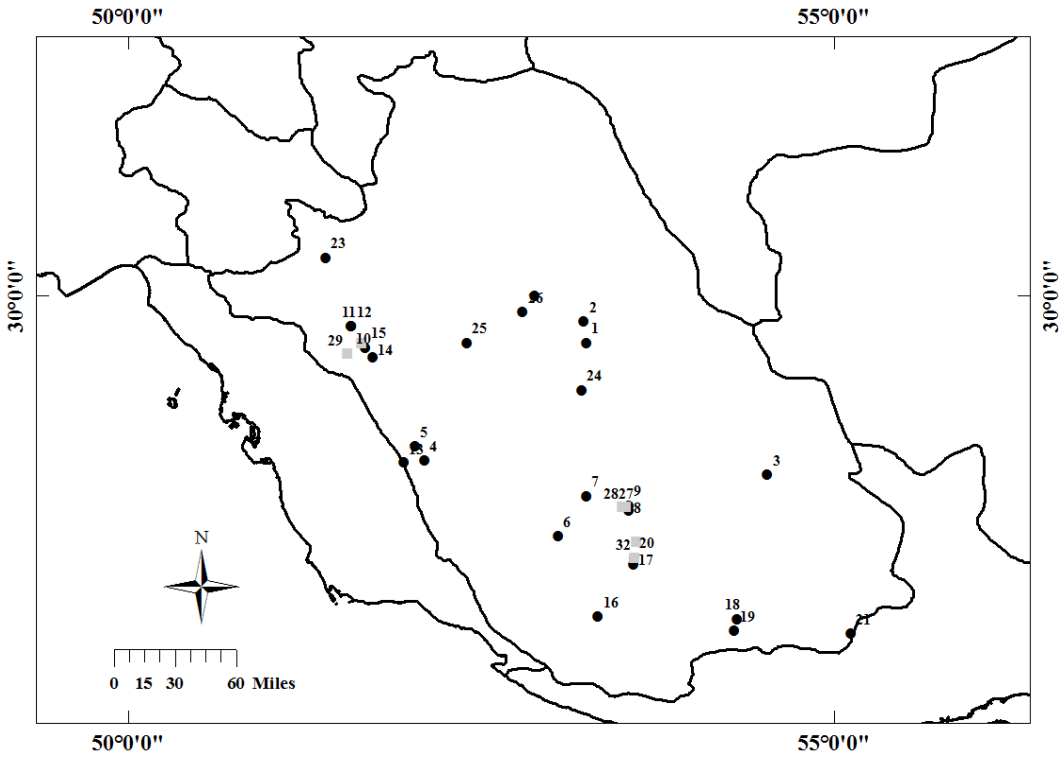

Figure 5

Records of *R. muscatellum* in Fars Province. Circles represent records in the present study and squares represent published records.

This species (Fig. 2-F) was found along with *R. microphyllum* in a relatively large tunnel in Larestan's Ab Barik On May 16th 2008. In a valley at the beginning of Farashband, some big rifts were visited and about 70 *R. muscatellum* were found On May 14th 2008. On the same date, Abgarm village in Ghir was visited and a rift including 40 *R. muscatellum* and two *R. aegyptiacus* were found. A

small cave in Darab's Forg located in 4 km southwest of Shahmarz village (a terrain called Galooye Ab Bordeh) was visited and 17 *R. muscatellum* were found On May 20th 2009. This cave is 16 meters long by 6 meters wide. This species was observed along with other two Rhinopoma species in Dokohak and Eshkaft-e khobrizi cave, located in Arsanjan town, in spring and summer 2014. The species is also recorded along with *R. aegyptiacus* and *R. microphyllum* from Dej-e Shahpur cave In Kazerun (Table 1).

However, previously, *R. muscatellum* were recorded from 10 localities of Fars Province (DeBlase 1980; lay 1967; Benda et al. 2012). Here we recorded this species from 26 localities that 22 records are new for the Province and the country. Therefore, 50.79 % of all occurrences (63 points) of the species in Iran are known from Fars (Fig. 5).

***Rhinopoma hardwickii* (Gray, 1831)**

Present Study

Locality 1- Arsanjan, Dokohak cave; **Locality 2-** Arsanjan, Eshkaft Khobrizi cave; **Locality 3-** Jahrom, Simakan, Shefagh cave; **Locality 4-** Khonj, Khan cave; **Locality 5-** Norabad-Showpari cave; **Locality 6-** Sarvestan, Codoni cave

Published data

Locality 7- a cave 10 km. E Kazerun (DeBlase 1980); **Locality 8** – Ahmad Mahmoudi, 1 mi NW, (van Cakenberghe & de Vree 1994); **Locality 9** – Lake Famur, (Lay 1967; DeBlase 1980)

Only twelve record sites were known from a limited range of the south-western part of the country that 3 were from Fars Province (Lay 1967; DeBlase 1980; van Cakenberghe & de Vree 1994). Nevertheless, in this study we report the species (Fig. 2-C) from six new localities. Therefore 75 % of the Iranian occurrence records of this species are known from Fars Province (Fig. 6).

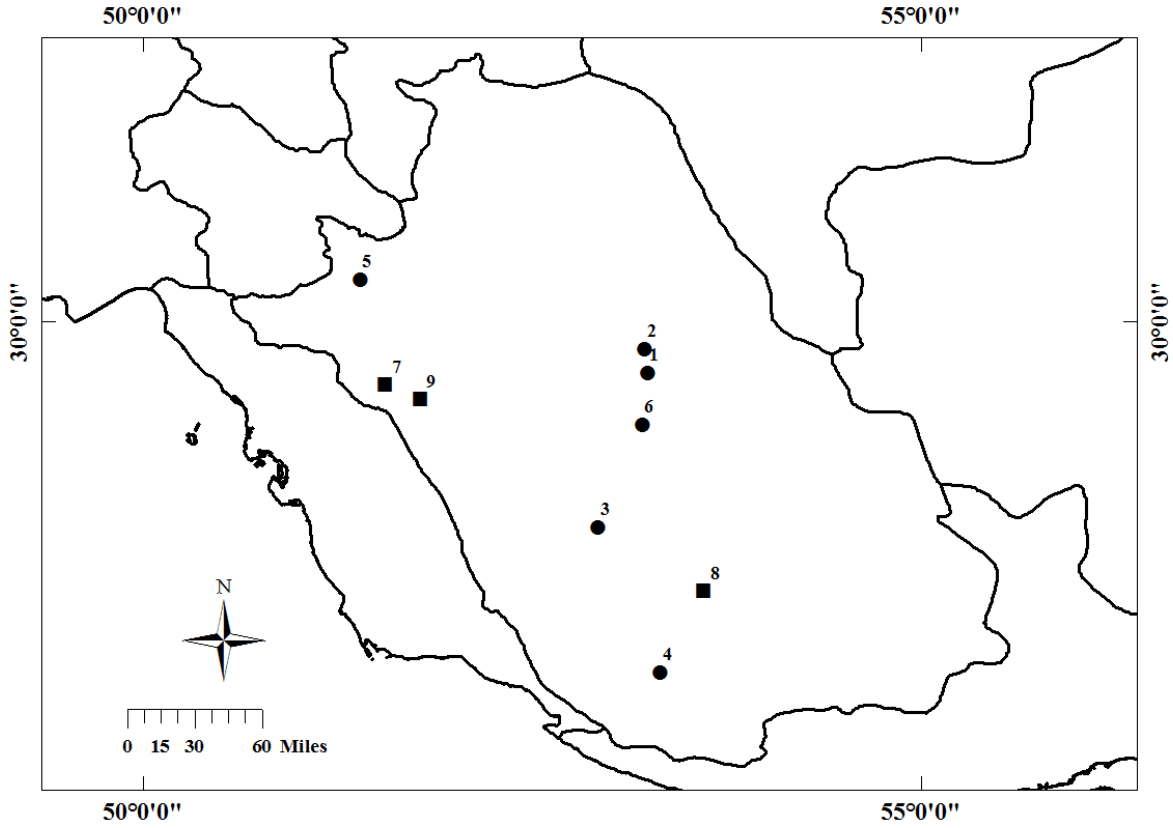

Figure 6

Records of *R. hardwickii* in Fars Province. Circles represent records in the present study and squares represent published records.

Family Hipposideridae (Leaf-nosed bats)

Three species *Hipposideros fulvus, Asellia tridens* and *Triaenops persicus* belonging to three genera have been reported from Iran. However, the two last species found to occur in Fars Province.

***Asellia tridens* (Geoffroy, 1813)**

Present Study

Locality 1- Jahrom, Fereshteh Jân, qanat; **Locality 2-** Jahrom, Sang Eshkan cave (Benda et al. 2012); **Locality 3-** Jahrom, Simakan, Shefagh cave; **Locality 4-** Kazerun, Khesht Cave; **Locality 5-** Kazerun, Tang-e Tikab cave; **Locality 6-** Khonj, Khan cave; **Locality 7-** Larestan, Old building in a garden; **Locality 8-** Norabad-Showpari cave.

Published data

Locality 9-10 km. SE Kazerun, (DeBlase 1980); **Locality 10** – Jahrom, abandoned buildings, (Lay 1967; DeBlase 1980); **Locality 11**– Kazerun (Etemad 1967, 1984) (Vercammen-Grandjean et al. 1970, DeBlase 1980); **Locality 12-** Rabatak, abandoned house (Lay 1967; DeBlase 1980).

Totally *A. tridens* (Fig. 2-G) are known from 43 and 12 Localities (Fig. 7) in Iran and Fars Province respectively. This species have been previously reported from four localities in Kazerun and Jahrom (Lay 1967; Etemad 1967; DeBlase 1980). In the present survey, we recorded this species from 8 localities in Fars Province of which 6 records are new. Therefore, 27.91 % of the Iranian records of this species belong to Fars Province.

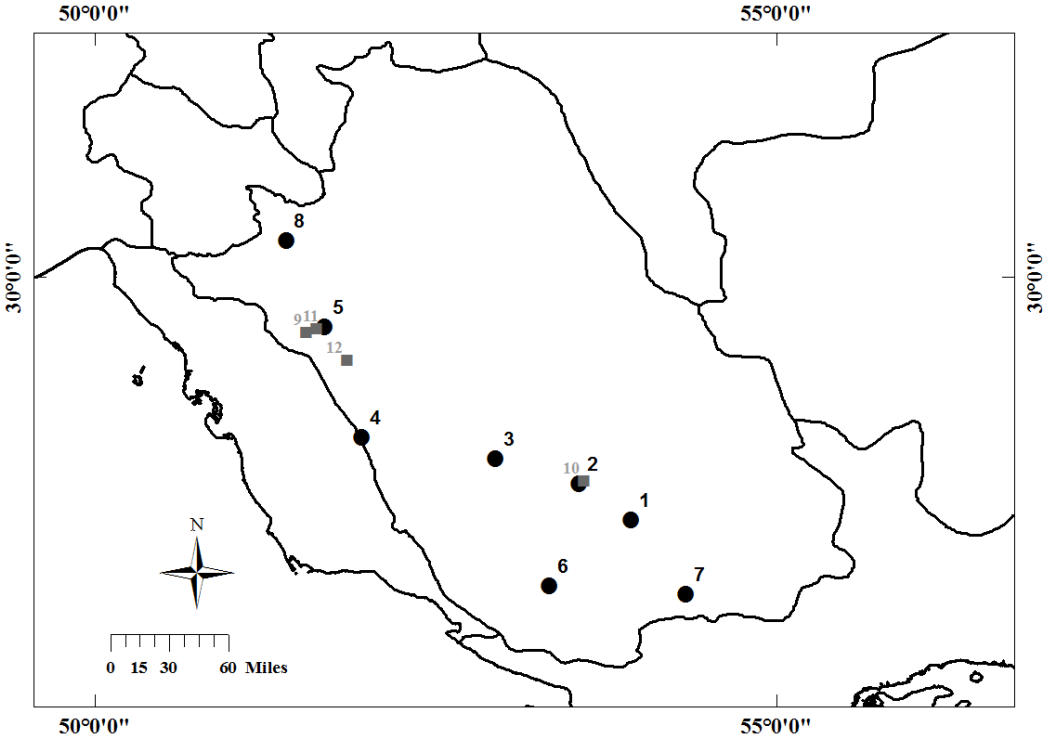

Figure 7

Records of *A. tridens* in Fars Province. Circles represent records in the present study and squares represent published records.

***Triaenops persicus* (Dobson, 1871)**

This species had been recorded from four localities of Iran including two localities from Bushehr Province, one locality from Sistan va Baluchistan Province and one localities from Shiraz town in Fars Province (DoBson 1871; Blanford 1876; DeBlase 1980; Harrison 1955; Turni and Kock 2008; Benda and Vallo 2009). In the Present study, this species is reported from Jahrom, Sang Eshkan cave. Therefore, from five Iranian records, two records are from Fars Province (Fig. 8).

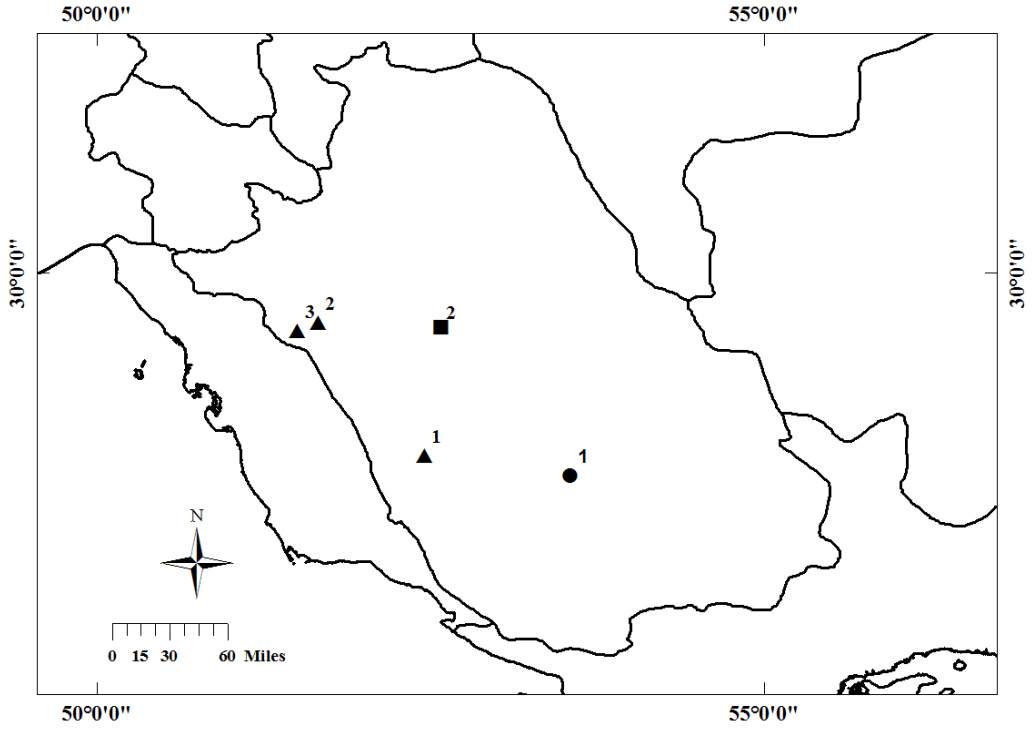

Figure 8

Records of *T. persicus* in the present study(circle) and published data (square) along with published records of *M. emarginatus* (Triangles) .

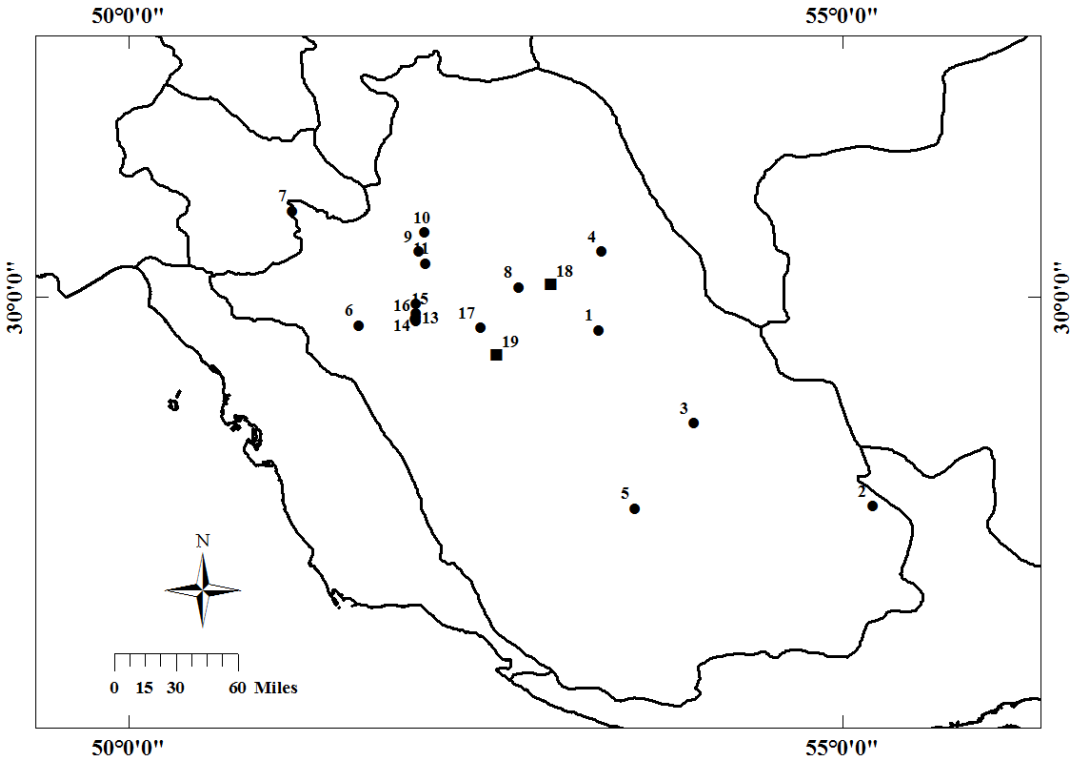

Figure 9

Records of *R. ferrumequinum* in Fars Province. Circles represent records in the present study and squares represent published records.

Family Rhinolophidae Gray, 1825 (Horseshoe bats)

***Rhinolophus ferrumequinum* (Schreber, 1774)**

Present Study

Locality 1- Arsanjan, Khong cave; **Locality 2-** Darab, Sahlak (Mozafar cave); **Locality 3-** Estahban-Zakaria cave; **Locality 4-** Ghader-Abad, Shabpareh cave; **Locality 5-** Jahrom, Tadovan (Canae Gabru) cave (Benda et al. 2012); **Locality 6-** Kazerun, Shahpur cave (Etemad 1967, 1984; DeBlase 1980; Benda et al. 2012); **Locality 7-** Mamasani,Gharibkhaneh cave; **Locality 8-** Marvdasht, Palangan cave; **Locality 9-** Sepidan, Angareh-Minu cave; **Locality 10-** Sepidan, Behesht-e makan cave; **Locality 11-** Sheshpir, Dalkhon cave; **Locality 12-** Shiraz, Balazar , Chemeh-Taalo cave; **Locality 13-** Shiraz, Balazar, Ghazal cave; **Locality 14-** Shiraz, Balazar, Balazar cave ; **Locality 15-** Shiraz, Balazar, Gelin cave; **Locality 16-** Shiraz, Balazar, Lampalangi cave; **Locality 17-** Shiraz, Pardis cave;

Published data

Locality 18- 5 km E of Sivand, remnant of one individuals (left mandible) found in *Bubo bubo* pellets; **Locality 19-** Shiraz (Cheesman 1921; Gaisler 1970; DeBlase 1980).

Figure 10

Rhinolophid bats from Fars Province: A- *R. hipposideros*, B- *R. euryale*, C- *R. mehelyi*, D- *R. blasii*, E- *R. ferrumequinum*.

Previously this species was recorded from 61 localities of Iran, of which four was from Fars Province. In This survey, we recorded *R. ferrumequinum* from 17 localities in Fars Province of which 15 was new. Thus, this species are known from 77 localities of Iran of which 19 localities (24.67 %) are known from Fars (Fig. 9). DeBlase (1980) reported this species (Fig. 10-E) from Shiraz. Recently, Benda et al. (2012) found Remnant of one individual (left mandible) in *Bubo bubo* pellets from 5 km E of Sivand, on 30 April 1996.

***Rhinolophus hipposideros* (Borkhausen, 1797)**

Locality 1-; Darab, Sahlak (Mozafar cave); **Locality 2-** Estahban-Zakaria cave; **Locality 3-** Jahrom, Tadovan (Canae Gabru) cave **(**DeBlase 1980); **Locality 4-** Kazerun, Shahpur cave **(**DeBlase 1980) **Locality 5-** Mamasani, Gharibkhaneh cave; **Locality 6-** Marvdasht, Palangan cave.

Published data

Locality 7-10 km. SE Kazerun, (DeBlase 1980); **Locality 8–**Shiraz (Spitzenberger 1979).

39 records of this species (Fig. 10-A) were reported previously from Iran (Benda et al. 2012). *R. hipposideros* was recorded from10 km. SE Kazerun and Shiraz by DeBlase (1980) and Spitzenberger (1979) respectively. In this survey, we recorded *R. hipposideros* from six localities from which the localities of Gharibkhaneh, Palangan, Sahlak and Zakaria caves are new. Totally eight records (20.51 %) of the Iranian *R. hipposideros* are known from Fars Province (Fig. 11).

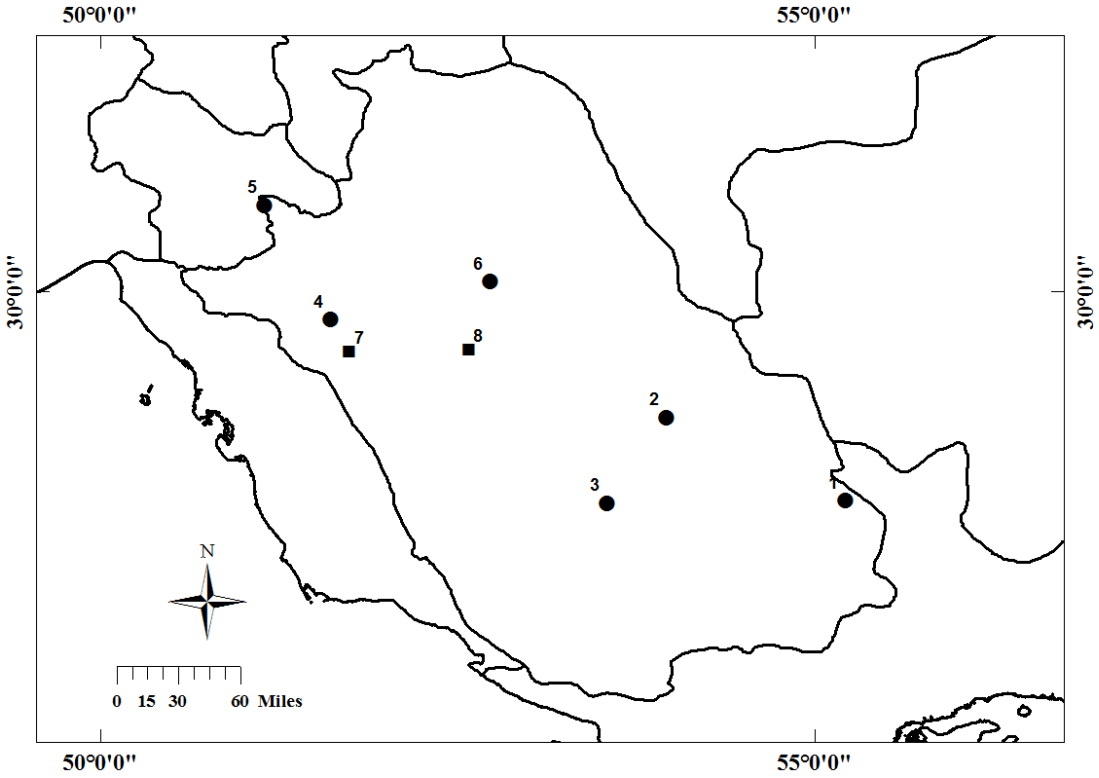

Figure 11

Records of *R. hipposideros* in Fars Province. Circles represent records in the present study and squares represent published records.

***Rhinolophus euryale* (Blasius, 1853)**

Present Study

Locality 1- Ghader-Abad, Shabpareh cave; **Locality 2-**Jahrom, Tadovan (Canae Gabru) cave (Benda et al. 2012); **Locality 3-** Kazerun, Shahpur cave; **Locality 4-** Marvdasht, Palangan cave.

Published data

Locality 5- Kazerun, Dej-e Shahpur cave, remnants of five individuals found in *Bubo bubo* pellets, **Locality 6** – Dashtak, 32 km SSW of Yasuj (Benda et al. 2012).

The Mediterranean horseshoe bat (Fig.10-B) is one of five Rhinolophid species occurring in Iran. This species was first recorded by DeBlase (1980) from Tadovan cave in Jahrom town. Benda et al. (2012) reported the species from Dashtak, 32 km SSW of Yasuj, and found remnants of five individuals (five right and five left mandibles, 4 skull fragments) in *Bubo bubo* pellets in a large cave above the Sâsân spring (= Dej-e Shahpur cave) located in Kâzerun. In the Present study, we report this species for the first time from Palangan cave and Shabpareh cave. We also observed one individual of the species from Tadovan cave in October 2015. Totally, *R. euryale* are known from 6 localities (Fig. 12) of Fars Province comprising 31.57 % of all records of the species in Iran.

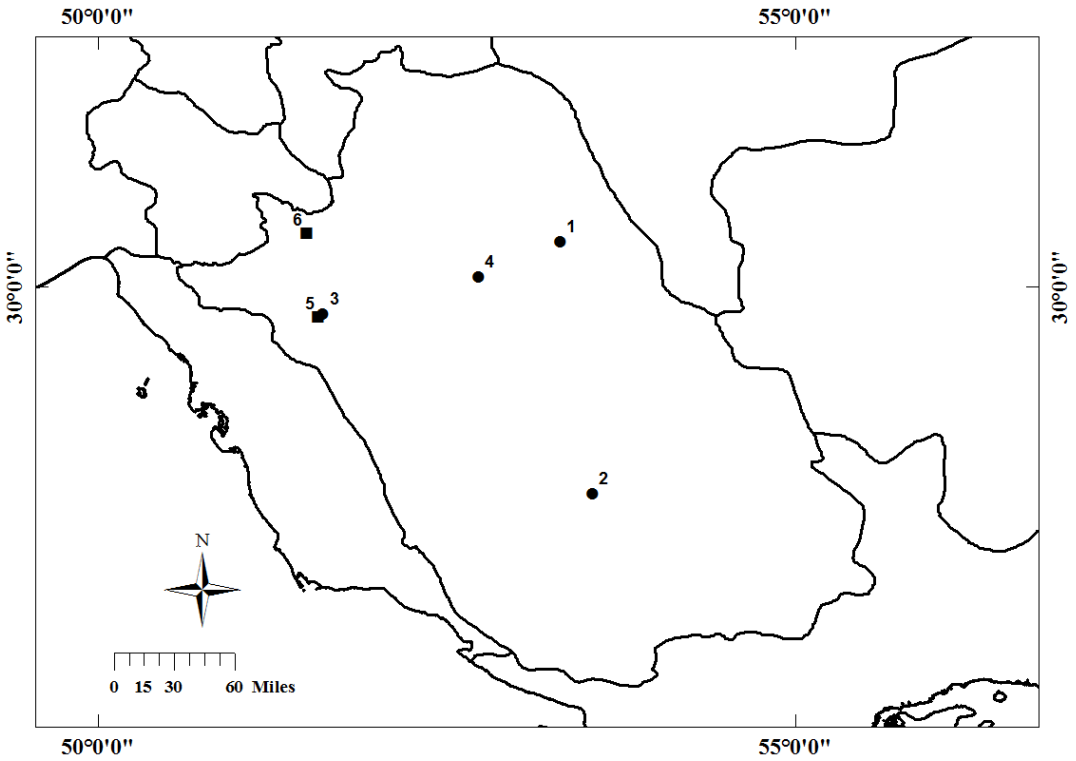

Figure 12
Records of *R. euryale* in Fars Province. Circles represent records in the present study and squares represent published records.

***Rhinolophus blasii* (Peters, 1866)**

Present Study

Locality 1- Darab, Sahlak (Mozafar cave); **Locality 2-**Jahrom, Tadovan (Canae Gabru) cave (DeBlase 1980); **Locality 3-** Larestan-Ahuh-Charkhab cave.

Published data

Locality 4- Marvdasht, Takht-e Jamshid (Persepolis), remnants of 1 individuals found in *Asio otus* pellets (Benda et al. 2012), Takht-e Jamshid (Persepolis) (Etemâd 1984).

At least 28 record sites are available from all parts of Iran with the exception of the central deserts. Etemad (1984) recorded one individual from Takht-e Jamshid (Persepolis), 11 km NE Marvdasht, while DeBlase (1980) recorded the species (Fig. 10-D) from Tadovan (Canae Gabru) Cave. Benda et al. (2012) found remnants of one individual in *Asio otus* pellets in ruins of ancient palace from Takht-e Jamshid (Persepolis). In the present study, it recorded from three localities of the province of which two records are new. Totally four localities (14.28% of Iranian records) for the species are known from Fars Province (Fig. 13).

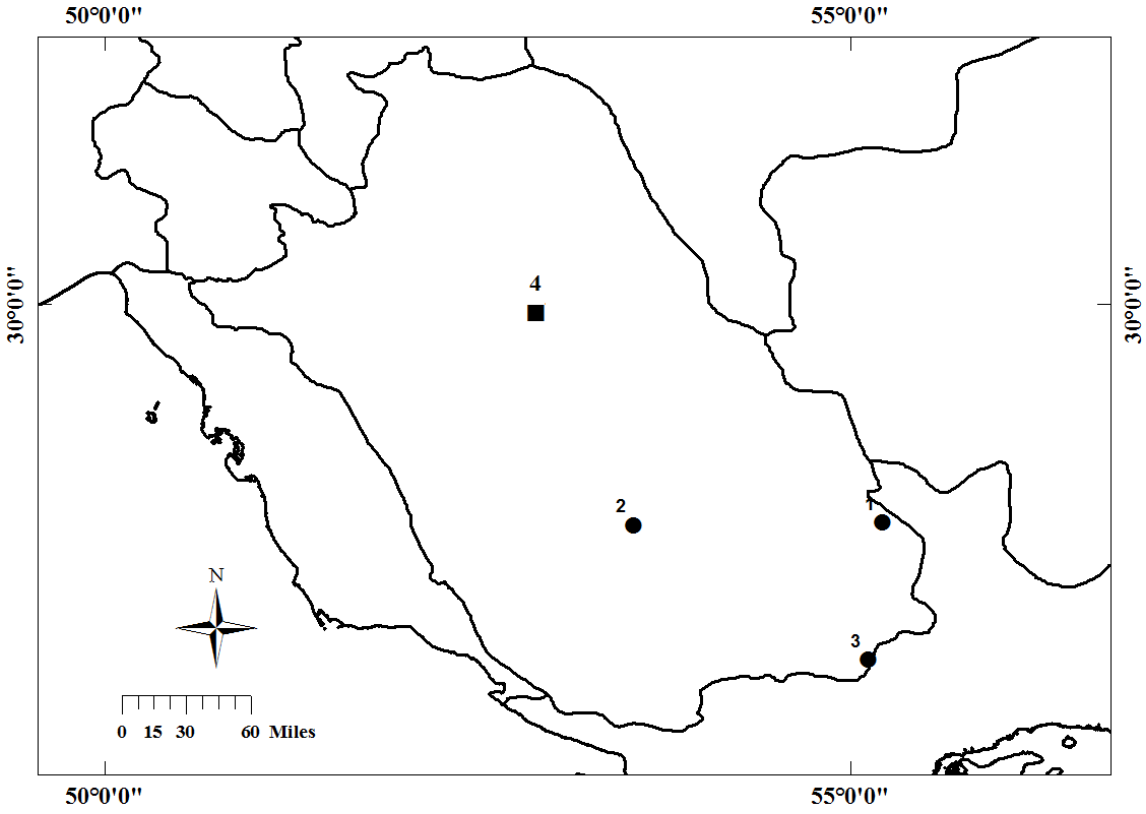

Figure 13

Records of *R. blasii* in Fars Province. Circles represent records in the present study and squares represent published records.

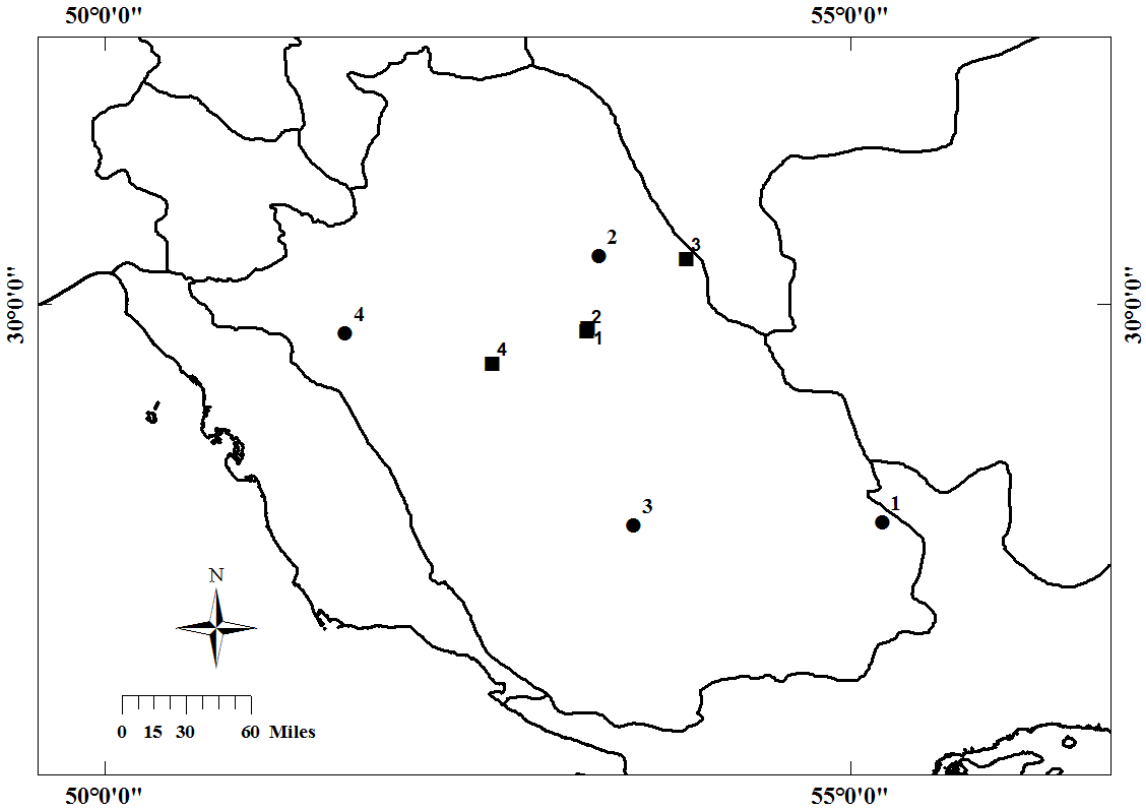

Figure 14

Records of *R. mehelyi* (circles) and *Rhinolophus sp.* (squares) in Fars Province.

***Rhinolophus mehelyi* (Matschie, 1901)**

Present Study

Locality 1-; Darab, Fath cave; **Locality 2-** Ghader-Abad, Shabpareh cave; **Locality 3-**Jahrom, Tadovan (Canae Gabru) cave; **Locality 4-** Kazerun, Shahpur cave **(**DeBlase 1972)

DeBlase (1971, 1980) reported the occurrences of *R. mehelyi* (Fig. 10-C) from Shahpur Cave in Fars Province while this species was identified as *R. euryale* from Shahpur cave by Lay (1967) and Etemad (1969). In the present study, we report this species from Tadovan, Fath and Shabpareh Cave. In recent years, no individuals of the species were observed in the Shahpur cave. Generally, *R. mehelyi* are known from 16 sites in Iran. One fourth of the Iranian occurrences are known from Fars (Fig. 14). We reports 3 distribution records of the species as new data from Fars Province.

Rhinolophus sp.

Locality 1-Arsanjan, Kaleh Nazari cave; **Locality 2-** Arsanjan, Eshkaft-e tireh kol cave; **Locality 3-** Bavanat, Kangowhar cave; **Locality 4-** Shiraz, Eshkaft Boland cave.

In the present survey, we observed some Rhinolophid bats occupying four caves. We could not Identified them at species level and considered them as *Rhinolophus sp.* (Fig. 14).

Family Emballonuridae (Sheath-tailed bats)

***Taphozous perforatus* (Geoffroy, 1818)**

T. perforates (Fig. 2-I) is a rare bat species in Iran, only seven localities are available from a limited area of the southern part of the country (DeBlase 1980; Benda et al. 2012). This species also distributed in Fars Province. On 8 October 2011, Benda et al. (2012) observed a colony of about 40 individuals from Sang Eshkan, artificial caves in Jahrom, and south of Fars Province. We also observed *T. perforates* (Fig. 15) from this cave.

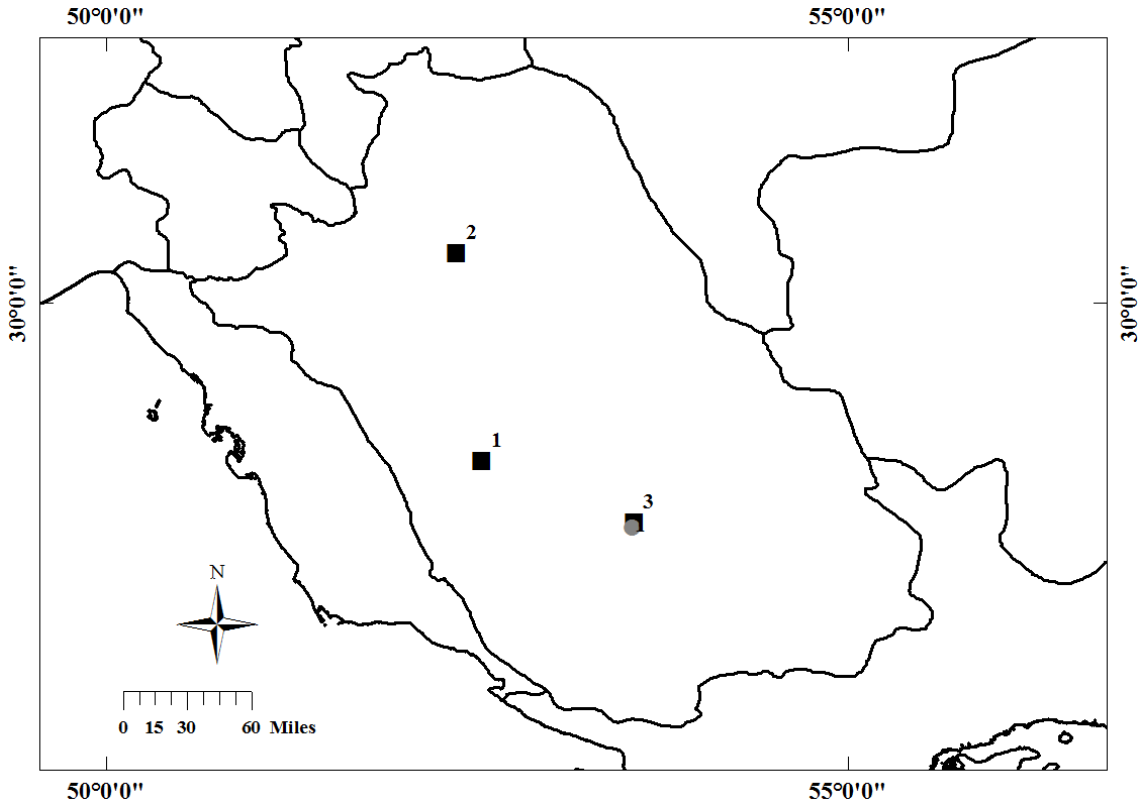

Figure 15

Records of *T. perforates* (circle) *and Tadarida teniotis* (squares) in Fars Province.

Family Vespertilionidae Gray, 1821 (Evening bats)

***Myotis blythii* (Tomes, 1857)**

Present Study

Locality 1- Firuz Abad, Serizjan cave; **Locality 2-** Ghader abad, Hana cave; **Locality 3-** Ghader-Abad, Shabpareh cave; **Locality 4-** Jahrom, Sang Eshkan cave; **Locality 5-** Jahrom, Simakan, Shefagh cave; **Locality 6-** Jahrom, Tadovan (Canae Gabru) cave (Benda et al. 2012); **Locality 7-** Kazerun, Dej-e Shahpur cave (Benda et al. 2012; Obuch 2011); **Locality 8-** Marvdasht, Palangan cave; **Locality 9-** Sarvestan, Chah jenni (tomp-e kocheh) cave.

Published data

Locality 10-5 km E of Sivand, remnants of 9 individuals in *Bubo bubo* pellets; **Locality 11** – small cave 3 km SW of Serizjan, 10 km N of Firuz Abad (Benda et al. 2006, 2011b); **Locality 12**– valley 10 km NW of Hesar, 66 km NW of Marv Dasht (Benda et al. 2012); **Locality 13-**Dashtak, 32 km SSW of Yasuj (Benda et al. 2006, 2011b); **Locality 14** – valley 11 km SE of Sarvestan, remnants of 1 individual found in *Bubo bubo* pellets; **Locality 15**– small cave 5 km E of Shangar, 50 km NW of Shiraz (Benda et al. 2012); **Locality 16-**Shiraz (Harrison & Lewis 1961, DeBlase 1980, Benda et al. 2006, 2011b).

Concerning the number of records (102 records), *M. blythii* (Fig. 2-H) is the first most frequently cave dwelling bat species in Iran. Its range covers mainly the mountainous areas of the northern, western and south-western parts of the country (DeBlase 1980; Benda et al. 2012). *M. blythii* are known from 16 localities (15.84 % of Iranian records) in Fars (Fig. 16). Here, we report this bat from nine Localities of which seven records are new.

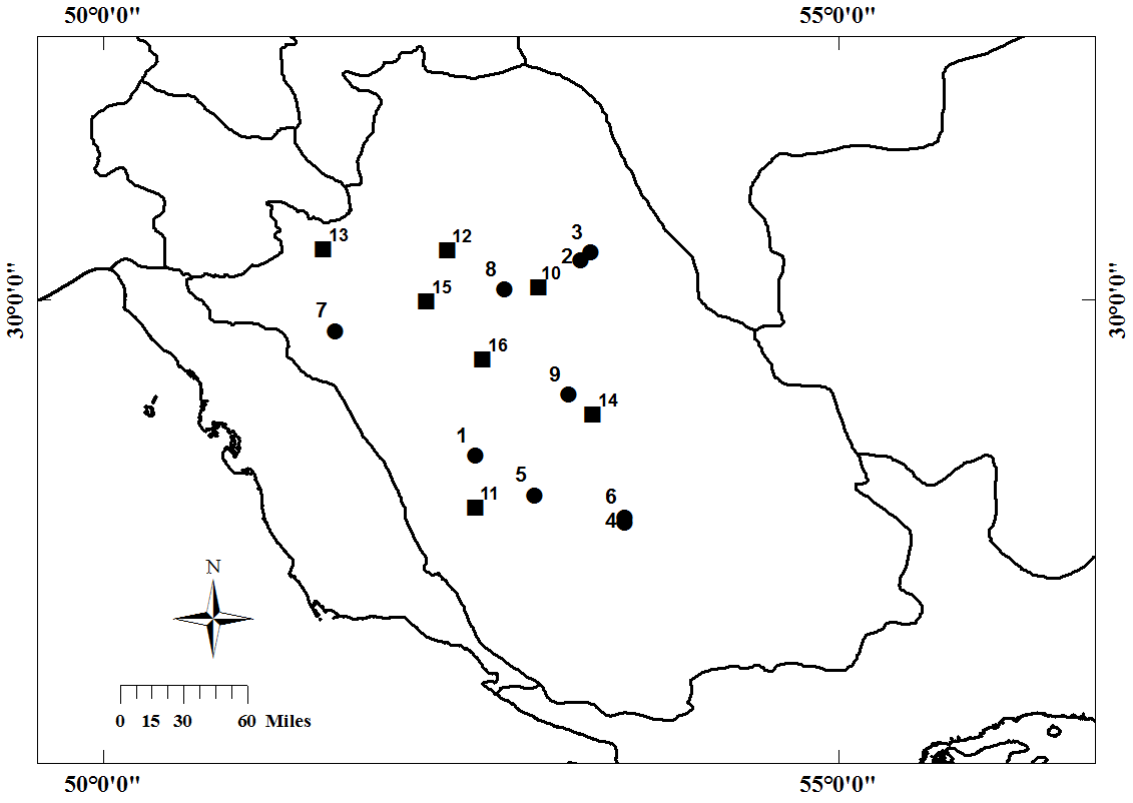

Figure 16

Records of *M. blythii* in Fars Province. Circles represent records in the present study and squares represent published records.

***Myotis capaccinii* (Bonaparte, 1837)**

Present Study

Locality 1- Jahrom, Tadovan(Canae Gabru) cave (DeBlase 1971; Benda et al. 2012); **Locality 2-** Marvdasht, Palangan cave; **Locality 3-** Jahrom, Sang Eshkan cave;

Published data

Locality 4- Kazerun, Dej-e Shahpur cave, remnants of 2 individuals found in *Bubo bubo* pellets (Benda et al. 2012); **Locality 5-** small cave in southeast of Pol-i-Abgineh, (Lay 1967; Etemad 1969; DeBlase 1980); **Locality 6** – 10 km. SE Kazerun (DeBlase 1980); **Locality 7-** near the ruins of the ancient city of Persepolis (DeBlase 1971, 1980); **Locality 8**– Kazerun, Shahpur Cave (DeBlase 1971).

M. capaccinii (Fig. 2-B) had been recorded from 11 localities of west and south of Iran (DeBlase 1980; Benda et al. 2012). Furthermore, we report this species from one new locality (Palangan cave) and two previously recorded localities in Fars Province (Table 1). Benda et al (2012) found remnants of two individuals in *Bubo bubo* pellets in a large cave above the Sasan spring in Kazerun (=Dej-e Shahpur cave, Table 1). This bat has also been recorded from a small cave in 3-5 km. southeast of Pol-e Abgineh, Kazerun and near the ruins of the ancient city of Persepolis (Lay 1967; Etemad 1969; DeBlase 1980). Generally, from 12 records of this species in Iran, eight records (Fig. 17) are known from Fars (66 % of the Iranian records).

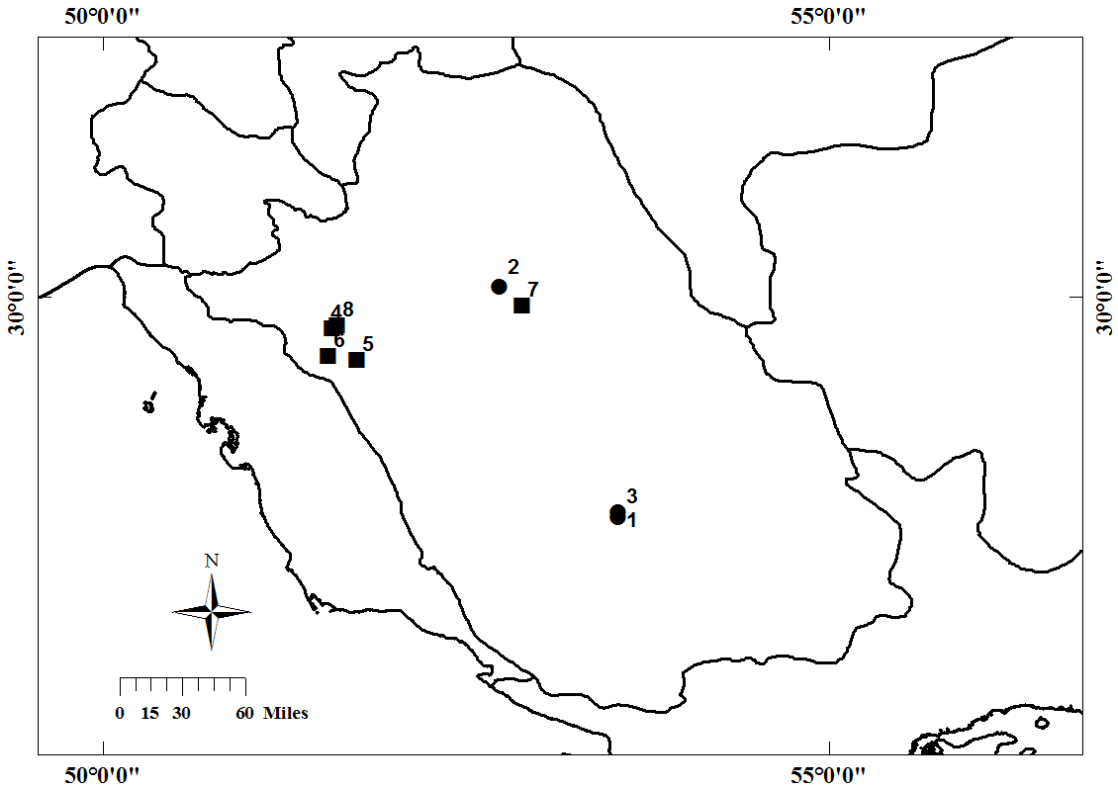

Figure 17

Records of *M. capaccinii* in Fars Province. Circles represent records in the present study and squares represent published records.

***Myotis emarginatus* (Geoffroy, 1806)**

M. emarginatus, is known from 20 localities of Iran that three records (Fig. 8) are from Fars Province (DeBlase 1980; Benda et al. 2012). It recorded by Etemad (1967, 1969) and DeBlase (1980) from Kazerun and Konar-Takhteh Respectively. It also recorded from a salt cave in Kuh-e Jahani, Khurab in April 2009 by Benda et al. (2012).

Family Molossidae Gervais, 1856 (Free-tailed bats)

***Tadarida teniotis* (Rafinesque, 1814)**

T. teniotis are known from 26 and 3 localities in Iran and Fars Province (Fig. 15) Respectively (Benda e al. 2012). Echolocation calls of some individuals from a small cave in 10 km N of Firuz Abad and calls of 5 individuals below the Tadovan cave were detected by Benda et al. (2006, 2012). One individual of this species were also netted in a valley 10 km NW of Hesar, 66 km NW of Marvdasht, above a stream by Benda et al. (2012).

Family Miniopteridae Dobson, 1875 (Long-fingered Bats)

***Miniopterus pallidus* (Thomas, 1907)**

Present study

Locality 1- Darab, Sahlak (Mozafar cave); **Locality 2-** Eghlid, Dasht-e bokan, Lileman cave; **Locality 3-** Ghader abad, Hana cave; **Locality 4-** Ghader-Abad, Shabpareh cave; **Locality 5-** Ghaemiyeh, Kaleh Kaftari cave; **Locality 6-** Jahrom, Simakan, Shefagh cave; **Locality 7-** Jahrom, Tadovan (Canae Gabru) cave (Benda et al.2012); **Locality 8-** Kazerun, Shahpur cave (Benda et al. 2012: remnants of 1 individuals found in the *Bubo bubo* pellets; Lay 1967; DeBlase 1980)**. Locality 9-**Marvdasht, Palangan cave.

Puplished data

Locality 10- 5 km E of Sivand: remnants of 2 individuals found in the *Bubo bubo* pellets, **Locality 11-** MarvDasht, 10 km NW of Hesar, **Locality 12**– Dashtak , 32 km SSW of Yasuj (Benda et al. 2012); **Locality 13-** 5 km. SE Pol-i-Abgineh, (DeBlase 1980); **Locality 14**– 11 km. NW Darab (DeBlase 1980).

Taxonomic studies of these species (Fig. 2-A) are very limited (Akmali et al. 2014). Using morphometric criteria, Lay (1967) provided the first revision of the taxonomic status of *M. pallidus* in Iran. However, recently Molecular study on the *M. pallidus* by Akmali et al. (2014) showed that the Miniopterus occurring in Iran and Azerbaijan are in fact *M. pallidus* not *M. schreibersii*.

Records of *M. pallius* in Iran are restricted to the mountainous areas of western, northern, and eastern Iran (Lay 1967; DeBlase 1980; Benda et al. 2006).

We recorded this species from 9 localities in Fars Province of which 7 were reported for the first time. *M. pallidus* are known from 56 localities in Iran and 14 localities in Fars Province (25 % of Iranian Records). Records of *M. pallidus* in Fars Province are shown in figure 18.

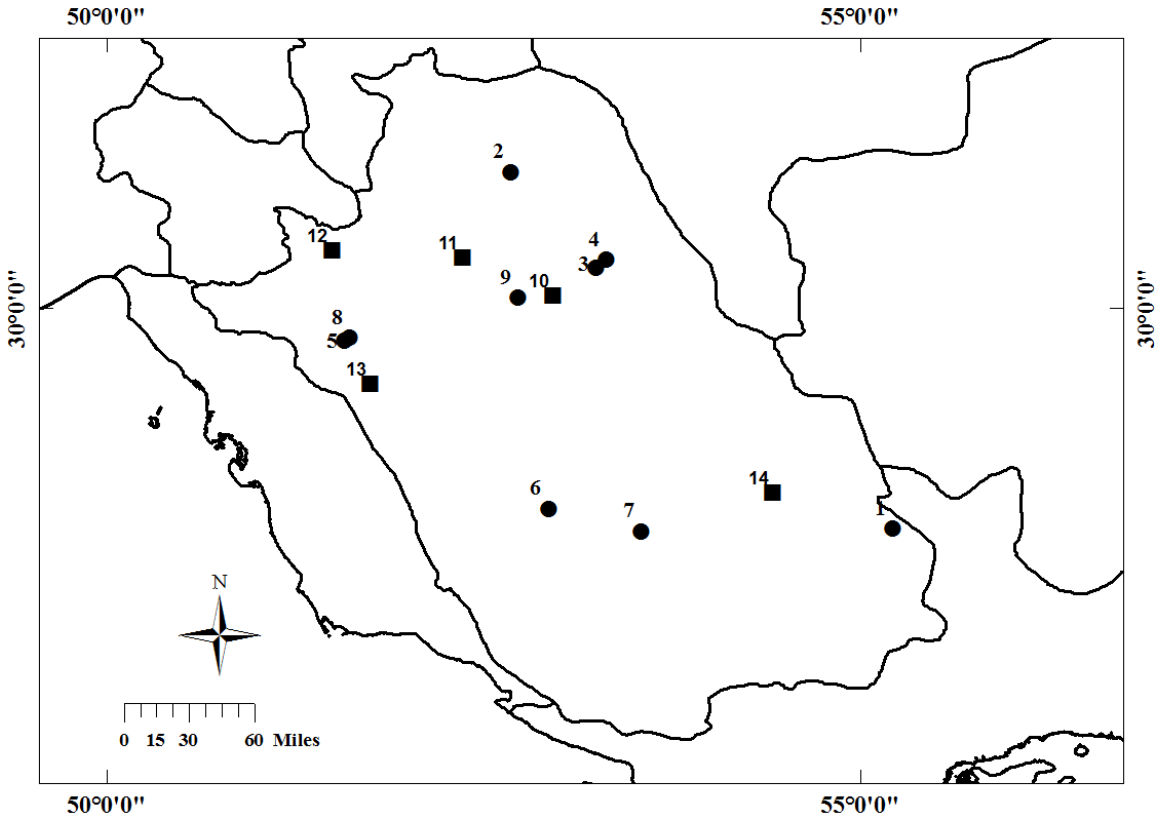

Figure 18

Records of *M. pallidus* in Fars Province. Circles represent records in the present study and squares represent published records.

Other bats in the Fars Province

The following bat species belonging to the family Vespertilionidae, have been recorded from Fars Province can be added to the bat fauna of Fars Province:

***Eptesicus serotinus* (Schreber, 1774)**

25 record sites are available from the country of which four records (16 %) are from Fars Province (DeBlase 1980; Benda et al. 2012).

***Eptesicus anatolicus* (Felten, 1971)**

Ten localities of the species are known from the country of which three records are from Fars. DeBlase (1980) reported it as *E. bottae* from NW Darab. Benda et al. (2012) found remnants of 2 individuals (2 right and 1 left mandibles) in *Strix aluco* pellets in a large cave above the Sâsân spring (= Dej-e shahpur cave) from Bishapur, 19 km NW of Kâzerun, and also above a pool in wadi below the Tâdovân cave.

***Hypsugo savii* (Bonaparte, 1837)**

19 record sites are available from different parts of the country (DeBlase 1980; Benda et al. 2012). There is only one record of this species from Fars Province (66 km NW of Marv Dasht) (Benda et al. 2012).

***Pipistrellus pipistrellus* (Schreber, 1774)**

Bats of the *P. pipistrellus* complex represent a very common bat form in Iran, at least 65 record sites are known from the country that 16 localities are from Fars Province representing 15.5 % of Iranian Records of the species. The species have been found in Kazerun, Marvdasht, Firuz Abad, Shiraz and Jahrom (DeBlase 1980; Benda et al. 2012).

***Pipistrellus kuhlii* (Kuhl, 1817)**

P. kuhlii is a very common species in Iran, at least 108 record sites are known from Iran (Benda et al. 2012). However, these bats are known from 18 localities of Fars Province (16.82 % of Iranian Records) (see Benda et al. 2012) that one locality is reported in this study from Arsanjan town of the Province.

***Otonycteris hemprichii* (Peters, 1859)**

Fifteen record sites are available from the southern and central parts of Iran. Benda et al. (2012) reported one specimen from Kâzerun town.

***Nyctalus leisleri* (Kuhl, 1817)**

N. leisleri is an infrequent bat species in Iran. It was recorded from nine localities in the country. Only one record of this species has been reported from the Zagros Mountains of the northern part of the Fars Province in Abadeh town by DeBlase (1980).

The results of this survey illustrate that the bat fauna of Fars Province is extremely rich.

Of the 18 families of bats, eight families (Pteropodidae, Rhinopomatidae, Nycteridae, Megadermatidae, Rhinolophidae, Hipposideridae, Myzopodidae and Mystacinidae) are restricted to the Old World; six families (Noctilionidae, Phyllostomidae, Desmodontidae, Natalidae, Furipteridae and Thyropteridae) are restricted to the New World; and four families (Emballonuridae, Molossidae, Vespertilionidae and Miniopteridae) are found both in the Old and New Worlds (Mickleburgh et al. 2002; Simmons 2005; Teeling et al. 2005). From 12 bat families found in old world, eight families are found in Iran. All Iranian bat families also distributed in Fars Province (Pteropodidae, Rhinopomatidae, Rhinolophidae, Hipposideridae, Emballonuridae, Molossidae, Miniopteridae and Vespertilionidae). Thus, 44.5 percent of old world bat families distributed in Fars Province too.

From 24 bat species recorded in Fars Province, 10 species (Table 1) were recorded from the Tadovan Cave. Besides bats of the cave, Benda et al. (2012) reported *Eptesicus anatolicus* together with *Tadarida teniotis* above a pool of still water of the mostly dried Qarah Ahgaj River below the entrance to the cave. It shows a high diversity of bats specially horseshoe bats inhabiting in the cave.

The Shahpur cave, a very famous Iranian cave is frequently visited by tourists. It is one of the largest and most majestic caves in Iran, and it harbors a large and varied bat fauna. To date seven species have been reported from this cave: *R. mehelyi, M. pallidus, R. ferrumequinum, R. hipposideros, M. capaccinii, P. pipistrellus, and P. kuhlii* (lay 1967; DeBlase 1980). DeBlase (1980) found five females of *R. hipposideros* in the Shahpur cave on 9 October 1962 but did not observed it on 29 December 1962. It indicates that this cave, or at least such exposed and conspicuous areas of this cave, is not used as a hibernaculum. The wintering of *R. mehelyi* in Iran was observed only in the Shahpur cave by Lay (1967) on 29 December 1962. DeBlase (1980) noted that "Shahpur cave is apparently a major hibernaculum for *R. mehelyi*, *M. capaccinii*, and *M.pallidus*. However, we visited this famous cave several times (last visit on 25 September 2015) in recent years. A few individuals of bat (less than 10 individuals) flying in the cave were observed in every visit of

the cave. In our last visit, on 25 September 2015, we did not see any bat in the cave. A major reason for decreasing the number of bats inside the cave is the disturbance of tourists visiting the cave.

According to the taxonomic revision by Benda and Vallo (2009), the distribution range of *Triaenops persicus* is relatively small, comprising a belt of coastal areas stretching from western Yemen, via Oman and UAE, to Iran and southern Pakistan. The other regions formerly considered a part of *T. persicus* range (Africa, Madagascar) were found to be inhabited by another species of the genus. The only known roost of *T. persicus* in Iran was recorded in the present study from the man-made cave of Sang Eshkan at the southern margin of Jahrom. The type locality of this species are from Shiraz in the Province. Totally, from five records of this bat in Iran, two records are from Fars province. *Taphozous perforatus* is a rare bat species in Iran, only seven localities are available from a limited area of the southern part of the country (Benda et al. 2012). This species was recorded in this study and by Benda et al. (2012), from Sang Eshkan cave.

Other rare species in Iran are *M. cappcinii* with only 12 occurrence points in the country from which seven records are from Fars.

Figure 19 represents a diagram showing the most abundant cave dwelling bats in the Province are *R. microphyllum* and *R. muscatellum* and then *R. ferrumequinum, R. aegyptiacus* and *M. blythii*. Table 2 and Figure 20 show Among Iranian species, *M. capaccinii*, the three Iranian Rhinopomatid species, and *R. aegyptiacus* are mostly distribute in Fars province rather than all other parts of Iran.

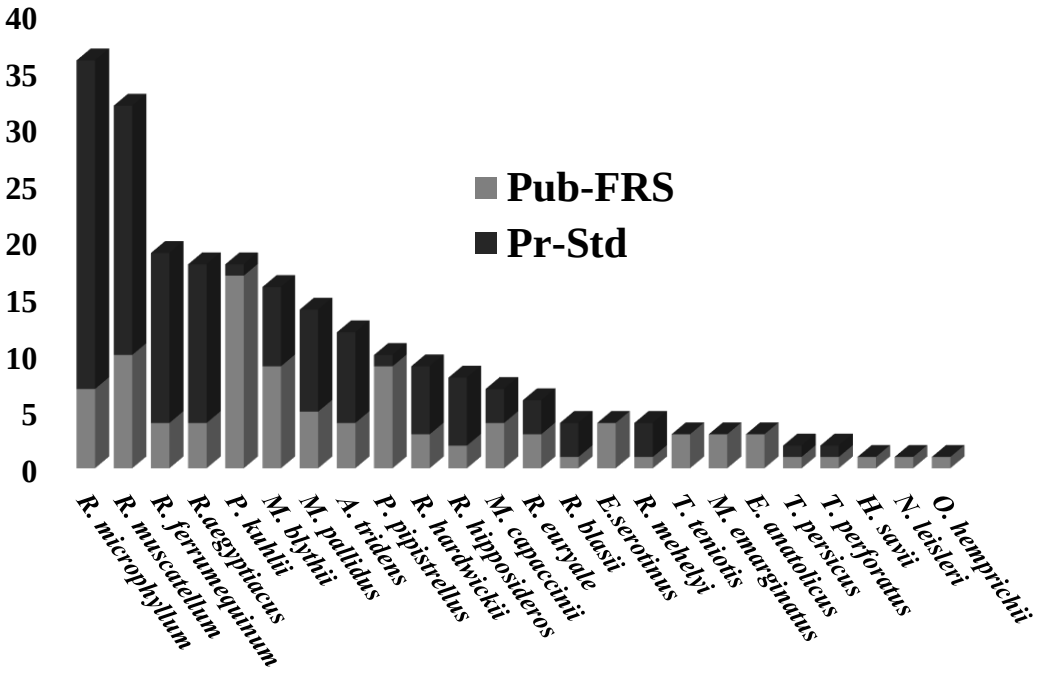

Figure 19

Total records number of each bat species from Fars Province including the published records (Pub-FRS) and records in the present study (Pr-Std) showing abundant bats in the Province.

The province can be divided geographically into two main parts, eastern-northern and western-southern parts as environmental temperature approximately increase from north toward south and from east toward west of the province. The western-southern parts are most suitable habitats for these the bats of families Rhinopomatidae, Pteropodidae, Hipposideridae and Emballonuridae. The bats of family Molossidae, Miniopteridae and Vespertilionidae are usually found in two parts especially in eastern-northern parts. Rhinolophid bats mostly are restricted to the eastern-northern parts. One the other hand, hibernacula of cave dwelling bats of families Rhinolophidae, Vespertilionidae and Miniopteridae situated in eastern-northern parts of the Province where the climate is coldest.

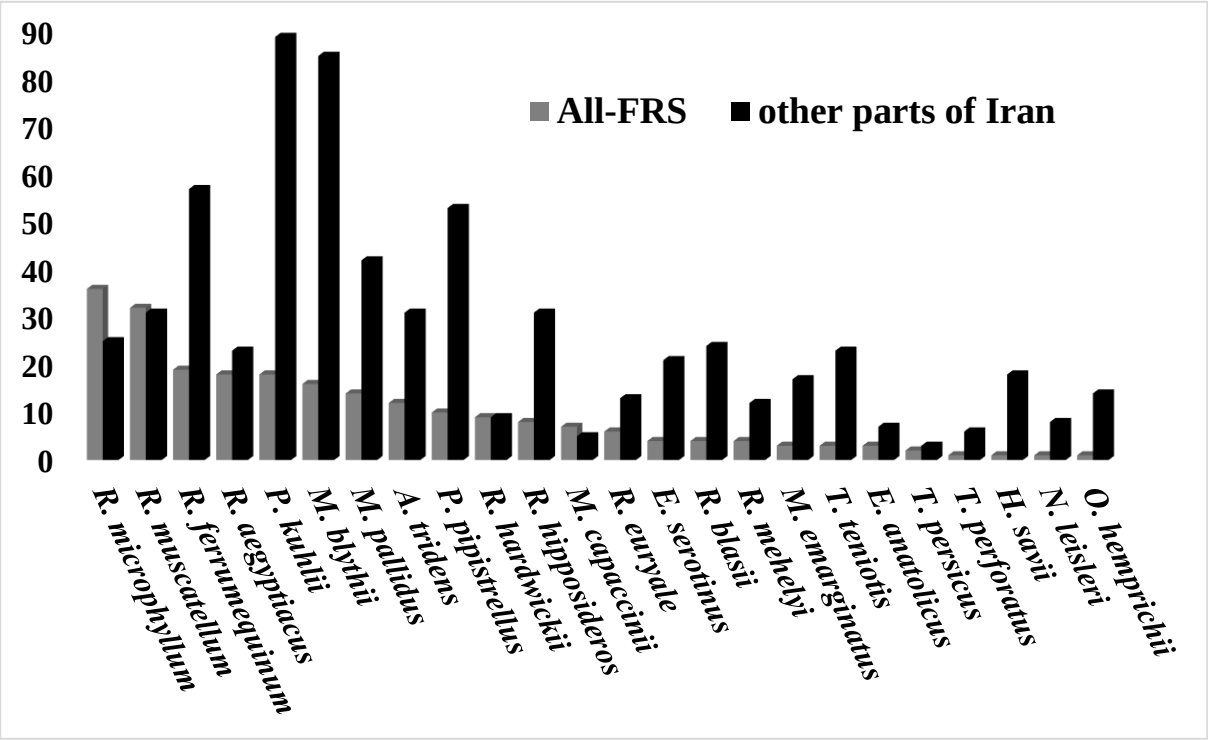

Figure 20

The records number of each bat species from Fars Province (All-FRS) and other parts of Iran, showing the mostly distributed bats in the Province rather than all other parts of Iran.

The geographical and climatic variation of the province causes varieties of plants and consequently variation of wildlife has been formed in the province. There are three different climates in the province. First is mild winter and cool summer, which are seen in the mountainous regions of north and north west of Fars. Second is rainy and cold winter with rough, hot, and dry summer that is considered as the signs of central regions. Third, moderate winters and very hot summers with few rainfalls in winter, spring, and summer, which are distinguished in south and southeast, which is due to the low altitude of the mountains (Salehizadeh et al. 2015). Generally in Iran and particularly in Fars Province, air Temperature is a function of height, latitude and the amount of moisture in atmosphere. Distribution patterns of bats in the Province show that these three distinct climatic regions provide suitable habitats for at least 48 percent of bat species distributed in Iran.

*Rousettus aegyptiacus***,** the only species of family Pteropodidae, and the bats of family Hipposideridae, Emballonuridae and Molossidae distribute in south and west of Fars where weather is warm. In these regions, warm adopted fruit tree like date (*Phoenix dactylifera*), citruses (Citrus sp.), fig (Ficus carica), pomegranate (*Punica granatum*), Ziziphus (*Zizyphus mauritiana*) are abundant which supply diet of Fruit bats (Albayrak et al. 2008). The bats of family Rhinopomatidae are mostly distribute in south and west of Fars but they migrate to central of the province in spring and summer. Because of these suitable environmental conditions, the mentioned bats more frequently recorded in the province. The horseshoe bats of family Rhinolophidae are mostly distribute in mountainous region of north and north west of the province and occasionally in moderate region of central and mountainous regions of south Province. The bats family Vespertilionidae are mostly distribute in the central of Province. Long winged bats of family Miniopteridae are mostly distribute in north and mountainous regions of west and south province.

4. CONCLUSION

Totally 237 records of seventeen cavernicolous bat species documented in Fars from which 143 records were new and reported for the first time in the present study. Compared with the current bat species found in Iran (50 species) (DeBlase 1980; Benda et al. 2012), 24 bat species recorded from Fars constitute almost 48 percent of the bats fauna of Iran, representing there are more suitable and diverse habitats for bats in the province rather than other parts of Iran. Conservation management should be considered and focused on the most important roosts with high diversity. According to finding, five caves including Tadovan (10 species), Shahpur

(seven species), Sang Eshkan (six species) Palangan (six species), and Shefagh (five species) have the most diversity of bat species in the province and need to be considered for protection seriously. It is suggested that these regions to be listed as a priority area for the establishment of protected areas for chiropteran conservation and survey work. The most abundant cave dwelling bats in the Province are *R. microphyllum* and *R. muscatellum* and then *R. ferrumequinum, R. aegyptiacus* and *M. blythii*.

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